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BERNHARD EDUARD FERNOW

DR. B. E. FERNOW IN FOREST HISTORY

By Filibert Roth

Nine centuries ago the "Charta de Foresta" of the Danish King Canute was promulgated in England. Much and serious attention was given to forestry in practice and in law when King John was forced to sign his "Charta de Foresta," practically a part of the famous Magna Charta in 1215. No doubt more than one gentleman of New England had a copy of Manwood's "Forest Laws" of 1741 where much of the early English efforts at forestry and forest laws are recited both in English and in Latin texts. William Penn appears to have been familiar with much of these early doings, and probably was impressed still more by the powerful appeals of Colbert and his great forest law of 1669 for France. During the past century in the United States there appeared now and then some remonstrances of mild protests against the rude and crude ways of the American lumberman and woodsman, but as late as 1876, or 100 years after the Declaration of American Independence, forestry was practically unknown in the New World, either in book or in practice. Congress had asked a few questions; the "Commissioner" of Agriculture, just about emancipated from the Patent Office, had collected odds and ends of stories about trees and woods. At the same time the American lumber industry had started on its remarkable and truly furious road of forest devastation and destruction.

At this critical time came Fernow, fresh from the Masters, fresh from the practice of the State Forest, with broad sound knowledge, faith, and enthusiasm.

By 1900 his teachings had gone from the Atlantic to the Pacific, had prompted many States to efforts in legislation, had secured the great law of 1891, the basic law for the creation of the National Forests, and his efforts had started the monographic study of our forest trees and our woods, and last, but not least, he had given the New World its start in forestry education and literature, both of which have done so much in the brief span of a quarter of a century.

History will credit Fernow for having started an intelligent understanding and appreciation of forestry, started right national policies and legislation, and directed the first work in laying a foundation for successful forestry practice by study and education in the richest and busiest nation of the World.

DR. FERNOW, THE PIONEER

By W. B. Greeley
Forester

We have always thought of Dr. Fernow as the pioneer forester in the United States. But it is indeed astonishing to note how completely, during his fruitful years as head of the Bureau of Forestry, the important movements were initiated which in their subsequent force and momentum have carried forest conservation in this country to where it stands today. He gave America her start in forest literature, with a series of monographs and bulletins whose number, breadth of field, and technical quality were phenomenal, particularly in view of the limited resources for research at his command. Not only did he lay the beginnings of the science of silviculture in the United States; he initiated the technical study of wood utilization, the research into timber physics and allied subjects which has subsequently grown to such large proportions and have brought such admirable results in conservation through better use of the timber which we already have.

His influence was felt in practically every State law dealing with forestry which was enacted during this period, the foundation stones of the State Forestry Departments and forest policies which are now taking such a large and splendid part in making the American people a timber growing nation. He started the forest plantations in the Nebraska sandhills, a striking prophecy of the progress to be made in tree planting. He was largely instrumental in securing the enactment in 1891 of the law which authorized the creation of Federal forest reserves from the public domain, an epochal event which initiated the National Forest system as it exists today. Through his unremitting work as a lecturer and publicist, through his large part in creating the American Forestry Association, through the cooperation which he secured from many prominent men of science, and through such far-sighted undertakings as the forestry exhibit at the World's Fair in 1893, he laid the basis for the education of the American people in forest conservation, for creating the popular understanding of the forest needs of the United States and the public sentiment which has made possible every successive development in public forest policies.

More than all this, he stamped upon the forestry movement of the United States its aggressive, missionary character. And, in importance equal to that of any of his other services, he initiated technical forestry education in the United States. It is a far cry from our forest schools of today back to the first course of technical lectures given by Dr. Fernow at the Massachusetts Agricultural College in 1887. But Dr. Fernow not only had the vision to foresee the need for a profession of trained foresters in the United States; he had a tremendous gift, as an instructor, of inspiring students with true professional zest and ideals. Particularly at its early and formative stage, he rendered an immeasurable service toward creating a profession of trained men not only with the technical qualifications but with the enthusiasm and zeal needed to carry forward the various lines of forestry work which he himself so largely initiated.

DR. B. E. FERNOW AS A MAN

By the President, University of Toronto

Death came gently to Dr. Fernow. He had no long wrestle with his last foe, but fell into unconsciousness several hours before the end and never came out of it. But he would have faced death, we may be sure, had he been in full possession of his natural powers, with the same courage that he displayed in his other experiences. His last appearance among his friends was on January 19, in Hart House, when he came in to hear Dean Graves, of Yale, address the Foresters' Club, and he must have been greatly pleased to receive the expressions of respect for his work and regard for his personal worth that were made by experts and former students. His feebleness on that occasion was a token to most of us that his remaining days would be few, and we cannot but be thankful that he has gone before his powers had so failed as to leave him little pleasure in life.

We wish to think of Dr. Fernow as he was in the fulness of his powers. He was then a man of great consistency of character. His walk and bearing were those of an upright man, and such he was. He was also one of the leading authorities on his subject in this continent, so much so that he has been called "the father of American Forestry."

Dr. Graves of Yale University, on the occasion above referred to, spoke of Dr. Fernow as the creator of modern forestry in the United States. Few in Toronto probably realized the position which he held in this department. Probably the years he spent in Cornell were those in which he had most unalloyed satisfaction, and the impression he made in those five years is shown by the fact that even today he is most warmly remembered in that University, and not many months ago a memorial was erected there to perpetuate his name.

In Toronto Dr. Fernow had to inaugurate a new faculty and that on a comparatively small scale. With all respect to his associates it may be said that for some years after its establishment when we thought of the Faculty we thought of Dean Fernow. Hampered though he often was, he quietly continued to do his best and at the same time to urge on the University and the public the needs of development. He saw the school grow from a score to over fifty and he gathered about him young men on whom he placed his own imprint. Staff and students

looked up to him as their unquestioned master. They were proud of him; they loved him; they could trust him to the uttermost. But he realized that much of his duty as Dean lay in informing the people of the Province as to the necessity for conservation. So he traveled and lectured. He was a clear and convincing speaker. He knew his facts; he would speak in palatable truths, for he was in a real sense a prophet of the conservation of our natural resources.

But more than that, he was a highly educated gentleman who knew what education meant and who sought to make his students educated foresters. He drew up a broadly educative course for the ordinary degree in forestry, and another combined course in arts and forestry, to both of which he insisted upon a high standard of entrance. He understood well that in the long run the best educated man is the most practical man, because he grows with the years.

Dr. Fernow also exemplified finely the office of Dean because he dealt with his students individually, and was interested in their personal development. For some he and Mrs. Fernow acted almost *in loco parentis,* and all were welcomed in their home. Here Dr. Fernow presided with dignity, finding his great pleasure in music.

Mrs. Fernow for years taught without any remuneration in some of the cultural subjects of the course and many a student looks back gratefully to her for the inspiration she gave because she loved to teach.

Of course the years from 1914 to 1918 brought supreme distress to Dr. Fernow, but all those who knew him admired his bearing throughout, his dignified silence, his endurance of sorrows, the deeper because of his fine character and because his own nature and ideals were so different from those of the men who were chiefly responsible for the world calamity. He was an American citizen and three of his sons were officers in the American army. Dr. Fernow never failed to act as a true man in circumstances which, thank God, few people have to pass through.

As has been remarked, he was a man whose refinement brought him respect and warm friends; whose aesthetic and intellectual pursuits made him an elevating companion. And when two years ago this University showed its high regard for him by giving him the honorary degree of Doctor of Laws, the honor was felt to be eminently deserved.

To Mrs. Fernow our hearts go out in deep sympathy. She entered into her husband's life with unusual penetration and understanding. She made him a home which those who had the privilege of entering it will long remember as a center of refinement and affection, and in all his trials she equalled him in high-minded patience. The memory of the just shall not perish.

DR. B. E. FERNOW—AN APPRECIATION OF HIS SERVICES[1]

By the Senate of the University of Toronto

Be it resolved that with the death of Professor Bernhard Eduard Fernow, on February 6, 1923, there passed from among us, in the fulness of service, if not wholly in years, a man of great attainment, one who will be long remembered as a loyal colleague and as the founder of forestry education in the University of Toronto.

Of whose life and accomplishment the following facts and sentiments of appreciation are gratefully recorded:

Bernhard Eduard Fernow was born in Inowraclaw, Province of Posen, Prussia, January 7, 1851. He received his early training in the gymnasium at Bromberg and entered the profession of forestry, following the regularly prescribed courses for government service at the Muenden Forest Academy. Coming to the United States in 1876, he first engaged in the metallurgical business, but at the same time offered himself for service as a consulting forest engineer, a profession at that time in America almost unknown. He began his advocacy of expert forest management and conservation through the medium of the newspapers and soon became prominently identified with the movement in the United States, and in Canada as well, for the second Forestry Congress was held in Montreal in August, 1882, where young Fernow attracted the favorable attention of the delegates by the clearness and force with which he presented his ideas, where, also, his geniality and charm of manner initiated lifelong friendships with prominent and influential men.

Out of the American Forestry Congress grew the American Forestry Association, of which for twelve years Dr. Fernow was secretary and the chief source of inspiration.

His work attracted the attention of President Cleveland and he was appointed by him Chief of the Division of Forestry of the United States in 1886. During the twelve years in which he occupied this position, he laid the substantial foundations upon which was built the present great organization of the United States Forest Service. He prepared the resolution presented to Congress in 1887, concerning the

[1]Moved by Dean C. D. Howe; seconded by Professor B. A. Bensley.

reservation and administration of all Federal timber lands, which became an accomplished fact in 1891. In 1892 he drew up the act providing for the administration of the forest reserves by technically trained foresters. This also became law, but not until 1905, when he had resigned from the Government service. Over thirty years ago he initiated the first reforestation project under the Federal government, which later gave rise to a reserve of 200,000 acres for planting in the sand hills of Nebraska. In 1888 he organized an extensive program for the investigation of the physical properties of American woods in order to determine their qualities for various commercial purposes. As a final outcome of this project the Forest Products Laboratory at the University of Wisconsin was established, and the Dominion Forest Products Laboratories at McGill University were later modelled upon it.

Dr. Fernow, long before any others in the United States, had a clear conception of the fundamental requirements for the development of forestry, its relationship to the State and to the industries. He always held steadfastly to the essentials; he never compromised with untried notions or with mere expediency. He brought the same vision to his work in Canada. He early saw the necessity for a stock-taking of the forest resources and a more adequate protection from devastation by fire. Consequently the greater portion of his time, outside of his academic activities, was given to their accomplishment. As Chairman of the Forestry Committee of the Dominion Commission of Conservation he was instrumental in obtaining a forest survey of three Provinces—Nova Scotia, Saskatchewan, and British Columbia. When the Commission of Conservation was abolished in 1921 an inventory of Ontario's forests was in progress. Under his direction the Commission made a very thorough study of the forest-fire problem in Canada and gathered extensive data as to the results of legislation and methods in the various American States, embodying all this in a report which is a classic of its kind.

Dr. Fernow had a unique capacity of envisaging a situation and comprehending its requirements. His mind, although rapid and apparently spontaneous in action, was closely analytical and logical in its processes. He at one time studied law at the University of Koenigsberg. His writings display the concise statement, the marshalling of evidence, and the attitude of pleading of a mind inherently legal in its attributes. His written works, also, display a rare and highly developed feeling

for term quality. There was no looseness of expression; every word he wrote had a precise and exclusive value. This attribute led to the frequent formulation of short expressions that contained a world of philosophy. His associates and students can never forget his oft repeated briefs that comprehend the fundamental principles of forestry, such as: "We must protect in order to practice;" "Save by intelligent use;" "Forestry is a function of the State."

He enjoyed a controversy as a mental exercise in clarifying ideas. His best expressions were brought forth at such times. He would characterize a situation or the weakness of an opponent's argument with cutting pungency, but always without malice. There was nothing personal about his controversies; he was simply defending certain forestry principles which he ever held supreme. He had just cause for resentments, but he never held them, and he would defend the men who treated him the most shabbily when their motives were attacked.

His mistakes, if we may call them such, were those of prevision, rather than of judgment. He was right and the majority were wrong. The proof of such a statement time alone can disclose and time has demonstrated it for him abundantly. For example, certain policies and lines of activity in forestry work, discarded by Dr. Fernow's immediate successors in the United States Government service, after some years of experience were re-instated and are now regarded as fundamental by the profession. Some of his actual silvicultural work in the forest was for years declared a failure, but the trees kept on growing and now they stand a living demonstration of the wisdom of his course. One of his severest critics once said, referring to a widely discussed controversy in which Dr. Fernow's judgment was concerned: "He is right in principle, but wrong in policy." Then he added prophetically: "Some day they will raise monuments to Dr. Fernow, especially in the State of New York." That remark was made twenty years ago. It is a source of profound gratification to his friends that the first monument was dedicated in 1922, while he still lived, in the form of Fernow Hall, at Cornell University. The value of the testimonial is enhanced by the fact that it was erected in the place where he met the severest disappointment of his professional career.

Dr. Fernow was the initiator, and remained the leader of education in forestry as long as he lived. In fact, for many years forestry education and Dr. Fernow were synonymous terms. The first course of lectures in technical forestry on the American continent was deliv-

ered by him in 1887 before the students of the Massachusetts Agriculture College. In 1891 he conducted a similar course at the University of Nebraska. He established the first forestry school in the new world at Cornell University in 1898, as Director of the New York State College of Forestry. In 1903 he delivered a series of lectures on forestry at Queen's University that attracted a great deal of attention and were included in government reports both in Ontario and Quebec. They were undoubtedly instrumental in bringing him here to establish and become Dean of the Faculty of Forestry in 1907.

Dr. Fernow's teaching was stimulating and inspirational. He held up ideals of achievement and disclosed vistas of paths along which the active mind might travel. He was a clear, concise, and convincing speaker. His lectures were brightened by humor and adorned by elegant phrase. Both he and Mrs. Fernow had a deep personal interest in the students. Their home was always open to them. The students of forestry were considered as members of the family and were always spoken of as "our boys." Dr. Fernow rarely criticised, but he had a gentle and tactful way of making a student realize his deficiencies. He recognized intuitively the psychological moment and a few quiet words of his have made the turning point in the careers of many of his students. Other foresters sought his advice. In the later years much of his correspondence was of this nature. Thus he kept in a close contact with the profession of forestry in all parts of the continent and exerted a profound influence on its development.

He was above all a public educator. The greater portion of his marvelous energy was exerted in this direction, and it will be for this that his name will go down to posterity. When he came to America in 1876 the word "forestry" could not be found in the dictionaries. The eleventh edition of the *Encyclopaedia Britannica,* published in 1910, contains eight pages devoted to forestry in the United States. This measures for the most part the result of his persistent, indefatigable work as a public educator. His articles written for newspapers and magazines, including Government reports, etc., number over six hundred. He prepared, or collaborated in the preparation of, over fifty Government bulletins. He edited ten volumes of the Proceedings of the American Forestry Association. He founded and further edited and published for fourteen years the Forestry Quarterly, and became the editor-in-chief of the JOURNAL OF FORESTRY when the latter replaced it. He was the author of two standard textbooks in forestry and of a book on the care of ornamental trees.

The value and magnitude of Dr. Fernow's work cannot be adequately measured or appreciated at the present time; its influence will grow with the increasing years. Only a few realize the extent and power of the obstacles he surmounted. In his earlier years in getting established in a strange country, he suffered disappointments and business reverses that would have submerged all but the most dauntless of spirits. Few can realize the discouraging and deadening effect of a stupendous public apathy, both in Canada and the United States, toward the conservation of natural resources. For years his was a lone voice in a wilderness of ignorance, opportunism, and complacency. That the tide is beginning to set in the opposite direction is due more than to any one factor to his facile pen and convincing argument.

The value of his work was recognized by universities, both in Canada and the United States. He received the honorary degree of Doctor of Laws from the University of Wisconsin in 1896, from Queen's University in 1903, and from the University of Toronto in 1920.

No discussion of Dr. Fernow's life and work would be complete without mention of Mrs. Fernow, whom he married as Miss Olivia Reynolds, of Brooklyn, New York, in 1879. Rarely were man and woman more happily mated. She entered into the activities and spirit of his work to an unusual degree.

Dr. Fernow was one man among thousands; his achievements were great; his personality, however, was his greatest and finest quality; always kindly, always courteous, always tolerant, and always unselfish. No matter how hard the toil, no matter what the discouragements, the body, mind, and spirit remained buoyant. And these qualities reached their supreme expression in his last illness.

There has passed from us a seer who had many of the characteristics of the prophets of old, a man who will rank high among those who have laid the foundations on which rests the prosperity of two great countries, an exemplar of an unselfish life wholly devoted to public service and, more important than these, a source of inspiration, a counsellor and friend of young men.

FORESTRY BUILDING NAMED FOR DR. FERNOW

On the afternoon of October 5, 1922, a significant event in the history of American forestry took place at Ithaca, New York, in the unveiling of a tablet bearing the name Fernow Hall, over the main entrance of the Forestry Building at Cornell University. The name is given in honor of Dr. Bernhard E. Fernow, in recognition of his life-long service to forestry in America. It was authorized by the Trustees of Cornell University at a meeting held June 20, 1922.

The exercises at the unveiling of the tablet consisted of brief addresses by Livingston Farrand, President of Cornell University; Albert R. Mann, Dean of the New York State College of Agriculture; and Professor Ralph S. Hosmer, Head of the Department of Forestry. The addresses dealt with Dr. Fernow's accomplishments in forestry and the many and varied contributions he has made in advancing forestry as a profession in the United States.

It is peculiarly appropriate that the building devoted to instruction in forestry at Cornell University bear Dr. Fernow's name, for it was at this institution that he organized, for the first time on the American continent, the subject of forestry for professional instruction.

The building now called Fernow Hall was erected through an appropriation made in 1911 by the Legislature of the State of New York. The building was dedicated in May, 1914, and has since that time been the home of the present Department of Forestry of the New York State College of Agriculture at Cornell University.

The honor that has been conferred on Dr. Fernow by Cornell University in the giving of his name to one of its important buildings is a source of great gratification to his many friends. It is a well merited reward for unusual and substantial accomplishment. And most happily it came while the recipient had the opportunity of knowing that the value of his life work was appreciated.

On the occasion of the unveiling of a tablet bearing the name Fernow Hall, the *Wood Turning* magazine for December, 1922, commented as follows:

Nothing could be more appropriate than the naming of the new hall at Cornell University in honor of Dr. Bernhard E. Fernow who founded there more than a score of years ago the first professional forestry

school in the country. It is true that this school was afterwards discontinued for a number of years, but this was due to the inability of the University authorities to grasp the real significance of forestry rather than to any fault of the dean.

Dr. Fernow brought to this country the thorough training of a German University and the culture and refinement of the old school Germans. In the early days of the Division of Forestry in the United States Department of Agriculture it was a practically unknown and insignificant branch of the government. Dr. Fernow was its chief from 1886 to '98 and during this period several publications of high scientific quality were issued under his direction. His studies in Timber physics were the forerunner of the First Products Laboratory at Madison.

In 1898 he was called to Cornell in the double capacity of dean and director of the newly established State College of Forestry. Scattered throughout the country there is today a small group of men who there had the benefit of what was the most inspirational teaching in forestry that ever has been experienced in this country. Dr. Fernow brought to his new work not only his European training but the benefit of broad experience in American forests. More than this he brought that quality of companionship with his students which is so rare in American college life. His versatility in languages, in music, in conversation and in many other ways made him popular in every circle.

His path, however, was strewn with difficulties. In order to furnish an object lesson in forestry the legislature of New York turned over to the management of the school a large tract in the Adirondack preserve. Like all Adirondack forests this was a mixture of hardwoods and spruce. In those days hardwoods were of no value and were never expected to be. Good forestry principles dictated that the hardwoods should be removed and replaced by spruce, which was already becoming valuable for pulp. In order to get a market for the hardwoods a large cooperage concern was induced to locate near the forest and given a long term contract for a large amount of wood. Reforestation with spruce and other conifers followed the cutting, but the plantations were small while the forests that had been cut were conspicuous. A great hue and cry was raised by some of the people who go to the Adirondacks for enjoyment, and by real estate speculators. As a result the state appropriations were withdrawn and the University failed to support its infant school. The abandonment of this school by Cornell was perhaps the greatest mistake ever made by the University and one which later enabled a rival institution to secure the State School of Forestry. This is the explanation of an anomalous situation whereby a state which does not permit the practice of forestry on its own lands, yet supports two institutions for teaching forestry to its people.

The discontinuance of the New York School of Forestry was naturally a great blow to Dr. Fernow, but with characteristic energy he turned his attention to building up a new school at State College, Pa. After a few years at this institution he was called to Toronto to assume the

duties of dean of the newly established forestry school. Here he has built up the strongest institution for forestry education in Canada, and one which has already influenced public opinion throughout the Dominion. His forest survey of Nova Scotia and other studies have given us the most accurate information available about Canadian timber conditions. No higher commentary could be written of Dr. Fernow than that he continued at Toronto throughout the great war although he was a German of Prussian origin and had entered Paris with the Prussian army in '72. What must have been the conflict of feeling between his love of his native land and his loyalty to his adopted country can be only dimly imagined by us who have never experienced such a conflict. It is sufficient to say that it was undoubtedly a factor in Dr. Fernow's premature breakdown.

One of the occasional pleasant memories of this terrible period will be that Dr. Fernow throughout the period was treated with the greatest courtesy by his Canadian colleagues and that at the close of the war he was given an honorary degree by the University he had served so faithfully. It is now an added satisfaction to note that our own University of Cornell has recognized our indebtedness to him by naming their forestry building Fernow Hall.

DR. FERNOW'S LETTER ON THE OCCASION OF UNVEILING A TABLET BEARING HIS NAME

Once more allow me to express my great regret at not being able to attend in person the ceremony of the dedication of your building and to return my grateful acknowledgment for the honor to you and those instrumental in having my name connected with the stately building devoted to the teaching of forestry. This recognition of my services is particularly grateful in that it comes from the institution where my work as teacher began and which has always commanded my loyal interest.

Had I been present I would have pointed out that my deserts are more than duly recognized by the handsome compliment of naming the building after me, and that it was only the accident of my being the first in the field and my persistence therein that gave me the proud position in which my friends have insisted on placing me.

I would also have elaborated the fact that a teacher lives in his students and that the honor heaped on the former is earned by the doings of the latter and would have enumerated the graduates of the earlier years now occupying prominent positions. My pride is centered in them.

To your students I would have recommended the adoption of my motto, borrowed from Horace, Carpe diem—doing the duty of the day—with confidence in the due development of the future.

The future for forestry seems full of promise and I would have congratulated all who are working in that profession.

B. E. Fernow.

DR. FERNOW'S LIFE WORK

As Seen by a Member of the Profession of Forestry [1]

By Ralph S. Hosmer

Professor of Forestry, Cornell University

It is perhaps appropriate that a few words be said here today by some representative of the profession of forestry. Dean Mann has spoken of Dr. Fernow's outstanding accomplishments. In what I have to say, I desire to stress the peculiar value of the services that Dr. Fernow has rendered to forestry in this country in the way of developing forestry as a profession.

It is only 36 years ago since Dr. Fernow became Chief of the then Division of Forestry of the U. S. Department of Agriculture at Washington. At that time Dr. Fernow was literally the only man in the United States who really deserved the title of professional forester. Indeed in one of his books Dr. Fernow says that the word forestry was then not even to be found in the dictionaries. Today forestry is an established and recognized profession in this country. It is indeed fitting that to the man who, almost single-handed, laid the first stones of the foundation there should be given the honor that has now come to him.

During the 12 years that Dr. Fernow was Chief of the Division of Forestry his was the guiding hand in almost every project that had to do with the advancement of forestry. Forceful as a speaker, and with the ability to write with clearness and vigor, Dr. Fernow had very much to do with creating an intelligent public interest in forestry. It was in no small part the public sentiment that resulted from this interest that made possible in later years the rapid development of the Forest Service.

Dr. Fernow was, however, not concerned merely with propaganda during those years in Washington. In his support of dendrological research, of experiments in tree planting in the Plains States, and the investigations in timber physics, that the Division of Forestry carried on, he was mindful of the scientific basis without which forestry could

[1] Delivered at the unveiling of the tablet at Fernow Hall, October 5, 1922.

not exist. Hampered throughout his administration by meager appropriations and assisted only by a very small staff, the accomplishments of that time are worthy of most grateful recognition. The timber physics work was but a beginning, but it foreshadowed the comprehensive investigations now being carried on by the Forest Products Laboratory of the Forest Service; so with other work which he started. It pointed the way to what has since been achieved.

On the side of legislation there was hardly a phase of forestry that was not touched upon by bills that originated with or were sponsored by Dr. Fernow. Most of these failed, it is true. The time was not ripe. But nevertheless due credit should be given for the attempts made to get these ideas into the statutes of the Nation. In State legislation, too, Dr. Fernow often lent a helping hand. He was one of those who helped draft the forest law of 1885 in New York State, whereby the Forest Preserve was established in the Adirondacks and the Catskills.

But without question the most important piece of legislation with which Dr. Fernow was connected was the Federal Law of 1891 that authorized the President of the United States to set apart portions of the Public Domain as forest reserves. This is the fundamental act on which rest our present National Forests.

In education in forestry Dr. Fernow had a part even as far back as 1887, when in his annual report for that year he outlined a course of study covering the entire field. In 1895 there were introduced in Congress two bills in favor of education in forestry, one of which provided for a post graduate school under the government. In 1887 at the Massachusetts Agricultural College and again in 1897, at the University of Wisconsin, Dr. Fernow gave courses of lectures that were the first attempts in this country systematically to present technical forestry matter to classes of students.

In 1898 Dr. Fernow was called to Cornell University to organize, as its Director and Dean, the New York State College of Forestry, the first school of forestry established on the American Continent. Perhaps Dr. Fernow's most notable accomplishment at Cornell was the organization of a forestry curriculum so logical in arrangement and so comprehensive in scope that it forms the basis of the standardized curriculum followed today by all the leading forest schools of this country.

Dr. Fernow set high standards for his students and rigidly enforced them. Never in the unfortunate controversy that arose in connection

with the college forest at Axton, and that led to the suspension of the college in 1903, was there criticism of the work given at the college. The value of the training they received is best attested by the records that have been made by the men who went out from under his instruction.

It was while Dr. Fernow was at Cornell that he published his "Economics of Forestry," easily one of the most important contributions yet made to American forestry literature. This is a book that, whatever his branch of work, the forester does well frequently to consult. Within its pages are to be found wise suggestions covering almost every phase of the many questions that are now the subject of professional discussion. It is as vital today as when it came from the press 20 years ago.

All foresters owe to Dr. Fernow a debt of gratitude for another contribution to the upbuilding of the profession, which he made while at Cornell in the establishment of the "Forestry Quarterly," a professional journal of high standards. This magazine Dr. Fernow conducted personally for a number of years. In 1917 it was merged with the Proceedings of the Society of American Foresters, and became the JOURNAL OF FORESTRY. Dr. Fernow retains the position of editor-in-chief, and still continues actively to direct its policy.

In the years immediately after his leaving Cornell, Dr. Fernow, in the capacity of consulting forester, did much valuable work as adviser to commercial companies and others, thus helping to establish the point of view that forestry is a profession ready at all times to render service. In these years, too, he organized the Forestry Department at Pennsylvania State College and gave a series of lectures at the Yale Forestry School, which later appeared in book form as his "History of Forestry," the only text in English covering this particular division of the field of forestry.

In 1907 Dr. Fernow was called to the University of Toronto, Ontario, Canada, where he again broke new ground by organizing the first forest school in the Dominion. Here as Dean of the Faculty of Forestry he labored until 1919, when by reason of age he was retired as Professor of Forestry, Emeritus. In Canada Dr. Fernow did not confine himself simply to teaching. As an influential member of the Commission of Conservation and in other ways he rendered to the Dominion the same type of service that had characterized his work south of the border.

He had no small part in the inauguration of forest policies in the Dominion.

Dr. Fernow's life has in no sense been placid. Of argumentative disposition he has ever been ready vigorously to defend the position that he believes to be correct. This trait has made him the storm center of many discussions, both within and without the profession. But his steady and consistent upholding of high ideals and strict standards of accomplishment has been of the greatest help and inspiration to all the members of the profession of forestry.

In an address that Dr. Fernow gave in 1916 as retiring president of the Society of American Foresters, the professional organization of this country, Dr. Fernow reviewed the progress of forestry for the 30-year period since his appointment to the office of Chief of the Division of Forestry. It is an interesting paper, tracing as it does the rapid development of a new profession and the expansion of the forestry idea under National, State and private auspices. To one familiar from the inside with the development of forestry in America, this paper is also most suggestive, in that between the lines it reveals the potent influence that was exerted by a few individuals in guiding the rapid progress that has taken place. As the first of these leaders of the profession of forestry in America, Dr. Fernow deserves especial honor.

American foresters must always owe him a deep debt of gratitude for the inspiration he has given them and for the example he has set through his own accomplishments. It is no idle compliment that the foresters pay him when young and old, in the United States and in Canada, the members of the profession unite in grateful recognition of his services in hailing Dr. Fernow as the Dean of American Forestry.

ADDRESS BY DR. LIVINGSTON FARRAND[1]

President, Cornell University

In Dr. Fernow's letter, read a few minutes ago, he implies with attractive modesty that it was the accident of his being the first in the field which enables us to be here this afternoon to do him honor.

It is no accident that brings about a career such as Dr. Fernow's. To be the first in the field in point of time, and to continue to be the first in the field in point of quality, is one of the rarest things in this world. Indeed, to make significant contributions to knowledge in any line is about the rarest thing we know in human life.

Such a career as Dr. Fernow's requires natural mental capacity; and besides intellectual gifts, it requires a highly specialized training. Added to these qualifications we find in him another attribute, not nearly so rare in itself, but unusual in combination with the other two, and that is the quality of industry. It was this habit of aggressive industry, of continuous, incessant, and unremitting work, added to his outstanding mental keenness and the thoroughness of his training, that gave Dr. Fernow's service its pioneer quality.

It seems to me that Dr. Fernow's career illustrates still other notable facts. In addition to his pioneering mind, he had a constructive mind; and to have a constructive mind means to be endowed with a great, and vivid, and outreaching imagination. Further, it requires a critical sense that acts as a check upon imagination. When you get the combination of these qualities you have the fundamentals necessary to the constructive mind but even that is not all. You must add the broad background against which new facts are judged, for without the sound judgment that comes from experience, imagination is likely to run riot. It is evident that the man whom we have met today to honor possesses in rare degree this unusual combination of qualities.

I value highly the privilege of extending on behalf of the University a word of appreciation of what Dr. Fernow has given not only to his particular science, but to knowledge in general, and to this University in particular. I welcome the opportunity to add the word of the

[1] Delivered at the unveiling of the tablet at Fernow Hall, October 5, 1922.

University as a whole to what has already been so capably expressed on behalf of the Department of Forestry and the College of Agriculture. It must be said that in naming a building for a such a man Cornell honors herself more than she honors him. We cannot, by such an act, add to Dr. Fernow's stature. The naming of Fernow Hall is in itself but a gesture, for Dr. Fernow's fame rests not on the fact that his name is here permanently recorded. It rests on his own work and that of the men whom he has trained.

APPRECIATION OF DR. FERNOW'S WORK BY HIS FORMER STUDENTS AND FRIENDS

The following are extracts from letters received by Dr. Fernow, upon the dedication of Fernow Hall, at Cornell University, Ithaca, N. Y., fall of 1922:

I desire to take this occasion to tell you that the Department has not forgotten, and I hope it never will forget, the work which you have done as one of the pioneers of forestry in this country and as the first head for twelve years of the Division of Forestry of the Department, in laying the foundations for the development and practice of that science. I hope that you may continue for many years to be the inspiring leader, as you have been in the past, of professional foresters both inside and outside of the Department.—Henry C. Wallace, Secretary of Agriculture.

All American foresters are rejoicing in the recognition which your work is now receiving by Cornell University, and they all join in wishing you many happy and fruitful days devoted to the three F's (which you used to hold up before your students)—Forestry, Friends, and Family.

You may have forgotten the incident at Berkeley, California, in the summer of 1901, when a gangling youth called upon you to ask advice about entering the forestry profession. You remarked that he was well qualified for it by his long legs. At any rate I have never forgotten it, for at that time my determination to cast my lot with the foresters was made. So you see I, too, like so many others, have something personal and distinctive to remember in my contact with you.—W. B. Greeley, Forester, Forest Service.

As one who in a small way endeavored to bring about the work of forest conservation in Canada, I am perhaps better able than most others to appreciate the great work which you have done.—Sir Clifford Sifton, Chairman, former Commission of Conservation, Ottawa, Ontario.

Permit me to say that I heartily join in this recognition. . . . There cannot be much difference in our age (I am over eighty-two now).—Sir W. Schlich, Oxford, England.

Gracious as this tribute is, it seems to me that the influence you have exerted on the lives of countless young men, to say nothing of the services rendered to the cause of forestry in North America, must serve as the best memorial.—Franklin F. Moon, Dean, New York State College of Forestry.

We owe you not only the genesis of two notable schools, but I think, too, the real inspiration to professional progress. Certainly, I, though not lucky enough to have been your pupil, have leaned heavily upon your far sighted wisdom. I hope you may appreciate the honor and gratitude with which we later comers regard you.—R. T. Fisher, Director, Department of Silviculture and Forest Management, Harvard University.

For many years your labors may have seemed to you to have been without adequate reward, but the results are now rapidly expressing themselves in the growing forestry work of the country. I think you may take much satisfaction and comfort in the assurance that your work is much appreciated.—L. H. Bailey, Ithaca, N. Y.

I trust that it is not too late to offer you the sincerest felicitations of myself and my staff, and to assure you of the great respect with which your name is held by foresters on this side, and of the high value placed on your services to forestry in general.—R. S. Troup, Professor of Forestry, University of Oxford.

Although you were at Penn State but a short time, the impetus which you gave to the work here has kept the Forestry School going strong. . . . It is a great satisfaction to us to be able to look back to such a man as you, and the fact that you did start this Forestry School will always be an incentive to young men. They will want to know about you and of the work which you did. Penn State is proud of her Forestry School and proud of the man who started it.—J. A. Ferguson, Professor of Forestry, Pennsylvania State College.

I have long regarded you as such a clear-visioned and efficient leader in the field of forestry that, without having a shadow of thought of disparagement of anyone else, I put your name in the foremost place. May you have satisfaction in remembering that you have many friends in Canada whose thinking and service have been all the better because of the work which you have done.—James W. Robertson, Ottawa, Canada.

When I recall that you were the first Chief of the Forestry Service in the United States and established its work upon foundations which have never been changed; when I remember that you established at Cornell the first College of Forestry on the North American continent, and that later at Toronto you established the first Forestry School in the Dominion of Canada; and when I recall, also, your numerous publications and the public addresses, I marvel at what you have been able to accomplish in a term of a single life. All the honors that have come to you—your recognition while at Cornell University, and the affection and esteem in which you are held by thousands of scientific workers in America are but the natural outcome of a great and unselfish service which you have rendered to the nation.—Stanley Coulter, Purdue University.

It is a just tribute to your establishment there of the first serious American School of Forestry; to your earlier foundation work of the present Forest Service at Washington; to your long and faithful work as Nestor of Forestry Educators on this continent.—E. A. Ziegler, Professor of Forestry, State Forest Academy, Mont Alto, Pa.

You are the sole living Honorary Member of the Pennsylvania Forestry Association, of which you were one of the founders, and on its behalf we wish to congratulate you.—Henry S. Drinker, Pennsylvania Forestry Association.

I count myself more fortunate than many in having, even for a short time, the intimate connection that I had with you all in Ithaca.—Irving T. Worthley, Philadelphia.

I often wonder whether you fully realize the esteem and affection with which you are regarded by foresters generally. No one has done more than you to place the profession of forestry in this country on a firm basis, and to further the adoption of a sound forestry policy. It is a constant marvel to me that one man can be a master in so many different fields, and a leader in so many varied activities. It is a satisfaction that comes to but few to look back over a life so full of achievement and public service.—S. T. Dana, Forest Commissioner, State of Maine.

You have been the inspiration for many men, to me especially, and I want to tell you how much I have appreciated your help and encouragement.—Ellwood Wilson.

I am very glad to know of this action to name the building after Dr. Fernow. Those of us who participated in the early undertakings of forestry in this country appreciate perhaps better than the younger foresters the real contribution of Dr. Fernow in laying the foundations of American forestry. He was one of the first men on the ground. He initiated the first national movement of forestry. For a long time he stood almost alone in calling upon the government to inaugurate a policy of handling the forests owned by the nation in the right way. It was his educational work that laid the foundations for the big progress that was made later on. His work led up to the law which authorized the establishment of public forest reservations. We all owe to him a deep debt of gratitude.

But it was not only in the public work in forestry that he performed a great service. From the very beginning he insisted upon high technical standards for the professional forester. Under his direction was established the first high grade technical forest school of the country. The standards which he set have had a very great influence upon forest education and upon technical forestry. His subsequent work at Toronto, and his many technical writings have always been a great aid in pointing out the great objectives of forestry, and in upholding the standards upon which our practice must be based.—Henry S. Graves, Dean, School of Forestry, Yale University.

. . . One more appropriate recognition of your long, arduous labors for forestry and for our people in the face of difficulties and disappointments. Slowly our people are seeing light, and with this our foresters and others are seeing the value of your work.—Filibert Roth, Professor of Forestry, University of Michigan.

Everyone interested in forestry will be glad and proud at this recognition which, though so sadly belated, has been most richly deserved.—Clyde Leavitt, Board of Railway Commissioners for Canada.

It is no small undertaking to be a pioneer, to overcome obstacles and force right thinking. It is even more perhaps to carry the light when one is not so much alone and the way less rugged. Maybe you don't know, what a goodly number of your younger associates are quite sure of, that you, more than any man, started forestry in this country, kept it going and established the high ideals that will carry it far. That is a real achievement, my good friend. Few can know so much.—Alfred Gaskill, Princeton, N. Y.

I shall always cherish the pleasant memories of the winter I spent at Camp Clearing on the Cornell forest tract as one of your hired men, helping in the marking of the timber, scaling of the logs, and keeping of the cost records on the hardwood operations, which you were carrying on there. The rare and brief opportunities during that winter that I had of spending in the woods with you, I often think back upon because I got so much from them that has been of help to me in the years since. I remember particularly one clear, cold winter's afternoon when I was following you around during one of your monthly inspections of the job, and you were discussing in some detail the methods of cutting you were following and the terms of the contract with the cooperage company, you remarked how one could often profit much more by the mistakes of his predecessors than by their successes; that is true, but you have given your followers little opportunity to profit by this means.—F. W. Reed, Forest Service, Washington, D. C.

It is just splendid that at last Cornell has honored herself by naming the building for you.—Walter Mulford, Professor of Forestry, University of California.

Fernow Hall will be but one of the monuments which are left as the result of your work and all of us look to you as the forester who laid the foundation not only in educational work, but in forest administration and practice not only in the United States, but in Canada.—C. R. Pettis, Conservation Commission, Albany, N. Y.

For myself, when I think of you, and I do often, the first thought that comes to mind and one which I can never disassociate with you, is that of your marvelous ability as a teacher. Your pupils were, indeed fortunate—fortunate far beyond the appreciation of those who were not so fortunate. It is the one thing that most of us recall, so I know that I am not alone in my appreciation of this wonderful ability of yours. . . . You must have noticed in your old pupils a deference to your opinions. This, I believe, is the finest tribute one can pay you because, in those that know you, it is a subconscious expression of their appreciation of your real worth.—H. R. Bristol, Chateaugay Ore and Iron Company.

You are the greatest teacher and all round educated man I have known. The entire Forest Service of today has not forgotten the value of your early leadership.—Wilfred W. White, Forest Service, Montana.

The recognition of your services by the profession within the last few years has been truly remarkable. I think as time goes on it is bound to increase as we are passing from the political stage of forestry to the real practice of forestry in the woods. . . . My travel to New England this summer drove home to me the remarkable foresight which you had twenty years ago. The key to getting spruce back in Maine, New Hampshire, and the Adirondacks is in the hardwoods.—Raphael Zon, Forest Service, Washington, D. C.

This acknowledgment, tardy as it is, of the great work you have done for forestry and for Cornell, is much appreciated by all those who have been so fortunate as to have known you and especially by those who had the privilege of attending the old New York State College of Forestery when you were Director.—R. C. Bryant, Professor of Forestry, Yale University.

It must be a perennial source of pleasure to you to know how well you taught at Ithaca—so well that none of us has ever come near attaining the high goal you set before us.—Frederick Dunlap, Missouri Forestry Association.

It might seem far-fetched to say that a man whom one has never met has been a real inspiration to him in a professional way. I am very sure this is true with myself and with a great many other men in forestry work, who have never known you personally.—Fred Morrell, Forest Service, Montana.

Cornell has, according to my notion, done an eminently fit and proper thing in giving your name to her first forestry building. What else could it have been called?—K. W. Woodward, Professor of Forestry, Durham, N. H.

My earliest recollections of forestry, and I am sure it is true of every forester in the country, are associated with you. The important part which forestry plays in the public welfare, at first realized by only a few, now by many, and eventually by all, will always be associated with your name.—Barrington Moore.

Most of us are probably too busy with our various tasks and interests to express to you as fully and as often as we should the loyalty and appreciation of your influence as a teacher, which we all feel.—E. A. Sterling, Timber Land Factor.

It is a privilege for me, a humble forester, to congratulate a great one on this occasion; and it is a pleasure for me to see my old teacher and friend thus honored.—Herbert Christie, Professor of Forestry, University of British Columbia.

I have been extremely glad to note at various times that at meetings of American foresters being held they made a special point of conveying to you an expression of their appreciation of your services to the development of forestry in America, and the foresters in Canada feel just the same way in regard to what you have done in this country.—Theodore W. Dwight, Professor of Forestry, University of Toronto.

EXTRACTS FROM LETTERS RECEIVED BY MRS. FERNOW AFTER DR. FERNOW'S DEATH

Dr. Fernow's name is so bound up with forestry at Cornell that it seems to us of the present school almost as if one of our number had been taken. We all revered him as a teacher, looked up to him as a great leader, and rejoiced in having had the rare fortune to know him as a man. Dr. Fernow played a unique part in the development of forestry in America. As a far-sighted organizer, an able administrator, and perhaps above all as a wise counselor, he will always be remembered for his many and varied services to the profession and to the nation.—Faculty of Forestry, Cornell University.

To those of us who are in forestry work he has always been looked up to as the father of the profession in North America. You know better than I can tell you the hard and pioneer work which he did and the courage, ability and patient perserverance which he showed in the face of ignorance, inertia and much active opposition. He has done a great work in the United States and in Canada.—R. H. Campbell, Director of Forestry, Ottawa, Canada.

As I look back now over the twelve years of official association with Dr. Fernow, I recall many situations that were difficult for him, and in a few cases only tact and generous forbearance on his part prevented open ruptures with the three Secretaries of Agriculture under whom he served. . . . They little understood or appreciated the man and the great constructive work he was doing.—George B. Sudworth, Washington, D. C.

Dr. Fernow's work will never die, but will be carried on as long as the Forest Service endures.—E. A. Sherman, Associate Forester, Washington, D. C.

His long life was a remarkably honorable and useful one, and his contributions to human progress have been exceptional in number and value, so that his name cannot be forgotten. In naming the Forestry Building, for him, we felt that we were recognizing in this simple material way his contributions to American forestry.—A. W. Mann, Dean, New York State College of Agriculture, Cornell University.

I am one who feels very keenly the sense of personal obligation to him. In my early days in Washington I looked up to him as a great leader. My greatest regret was then that I could not serve under him. Later, as I came to know more of him, my respect only increased, if at times it was not tinged by a bit of dread. In recent years I have come to appreciate more and more fully what a really great man he was and have been increasingly thankful that it was my good fortune to be brought more closely in touch with him. It is a privilege to have had this association. I feel proud to count myself one of his pupils, although I never came under him personally in class room or laboratory. In his passing a great figure has gone out of forestry in America, but I can but think that one who has done so much here only goes on now to a yet larger field of opportunity elsewhere. . . . The example that Dr. Fernow set must ever be an inspiration to all who follow the trails that he blazed and opened.—Ralph S. Hosmer, Professor of Forestry, Cornell University.

He certainly led a long and exceedingly useful life and has left an honorable name, and his memory will be cherished as among those who have made the world a better and a brighter place to live in because he has been in it.—Judge Isaac S. Signor, Albion, N. Y.

Only what was mortal in Dr. Fernow is gone. His spirit will live forever.—Raphael Zon, Forest Service, Washington, D. C.

All of us who have sat at Dr. Fernow's feet as students have lost a very, very dear friend.—Judson Clark, Pasadena, Cal.

Mere words cannot express the feeling which I have at his passing, and in common with all of his old students, I shall always carry the memory of his personality and influence. His work in forestry and as a moulder of character will always live in the men with whom he came in contact, and in the institutions which he represented. No one can hope for greater and more enduring monument to their memory.—E. A. Sterling, Philadelphia or New York.

He was the friend of my father's father, and the grandson had the privilege of sharing that friendship, too. Although I had not seen him for some time my heart always warmed at his memory—and will always do so.—Alan Joly de Lotbiniére, Montreal, Canada.

Those who will regret the passing of Dr. Fernow most, I think, will be his former students, all of whom were familiar with his rare qualities, both as a teacher and a gentleman. I am reminded now of the many pleasant hours which we spent with him in classes, and of his never failing courtesy and kindly manner upon these and all occasions.—Alan W. McCallum, Ottawa, Canada.

He was one of the biggest men I have ever met or am likely to meet, and his influence on the men who knew him at the School affected them probably more than they realized, not only as foresters but as men. I have always been glad that my course there was taken under him, and have felt a bit sorry for those who did not know him so well.—Alan Parlow, Vernon, B. C.

It is given to few men to be pioneers in a profession, and at the same time to dominate it for forty years or more. Your dear husband had that privilege. It was not his by gift, however; it was his by dint of labor, self-sacrifice, loyalty and partriotism in its broadest sense. No forester on this continent disputed the Doctor's occupation of the topmost pinnacle. It was his by right, and the love and esteem he engendered in his associates preserved that place to himself.—Ernest H. Finlayson, Ottawa, Ontario.

As the years have passed I have appreciated in ever greater measure the reason why Dr. Fernow occupied the distinguished place that was his in his chosen profession. He would have been eminent in any field of endeavor because his was a great soul in a world where they are rare indeed.—W. Kynoch, Ottawa, Ontario.

He was a great man. During the war he was in a trying position, but he bore himself with such dignity and tact that every discerning person admired and loved him the more for his fine qualities of character which the day of trial revealed. I always enjoyed his society and he has left an honored name as a heritage to his family.—George W. Wrong, Professor of History, University of Toronto.

CHRONOLOGICAL EVENTS IN THE LIFE OF B. E. FERNOW

1876—Arrived in the United States.

1878–1885—Managed a 15,000-acre tract for Cooper Hewitt & Co., in Pennsylmaking charcoal, and wrote on forestry, etc., for Birkinbines Journal of Charcoal Iron Workers.

1882—Attended meetings of American Forestry Congress in Cincinnati and Montreal and effected amalgamation with Dr. Warder's American Forestry Association.

1883—Was elected Secretary of American Forestry Congress at St. Paul meeting. Served as Secretary until 1895.

1884—Published three Forestry Bulletins, as a private venture.

1885—Formulated the legislation for the New York Forest Commission for Senator Lowe, which embodied the first organization of fire wardens.

1885–1897—Editor, 10 volumes of Proceedings of American Forestry Association.

1886—Accepted call to become Chief of Division of Forestry. Served as such until 1898.

1887—Delivered the first course of 12 technical lectures before students of Mass. Agricultural College.

Introduction of bill for reservation and administration of all federal timberlands (Hale Bill).

1888—Beginning of comprehensive Timber Physics work, investigating properties of American woods.

1889—Chairman Executive Committee of American Forestry Association (until 1898).

1890—Artificial Rainfall incident, see Report, Department of Agriculture.

1891—Reservation policy established through influence of Mr. Noble, Secretary of Interior.

Plantation on sand hills of Nebraska, which gave rise to 200,000-acre federal reserve for planting.

Lecture course started in Nebraska University.

Extension of forest reservations (8).

Address on National Wealth and Conservation before A. A. A. S.

1892—Ditto.

Senate Bill for Administration of Reserves (Paddock Bill) introduced.

1893—McRae Bill (H. R. 119) calling for a full organization of Forest Service introduced.

World's Fair Exhibit; also for German Government.

Further forest reservations secured.

1895—McRae Bill passed in both Senate and House, failed by accident to become law.

Vice-President, Section *I*, A. A. A. S. Address on *Conservation* of resources.

1895—Lecture course before Summer School at Colorado Springs.

Letter prepared for Secretary of Interior to ask advice of Academy of Science, gave rise to the first appearance of Pinchot in public service.

1896—Atlanta Exposition, in charge of Forestry Building.
Lecture course before School of Economics at Wisconsin University.
1897—Senate Document No. 40, giving estimate of conifer supplies.
1898—Editor "The Foresters," for the year.
Director N. Y. State College of Forestry (until 1903).
1902—Economics of Forestry published.
Course of lectures at California University.
1903—Editor Forestry Quarterly to 1916.
Course of lectures at Queen's University.
1904—Two courses of lectures before Yale Forest School.
1906—Opening forest school at Pennsylvania State College.
1907—Organizing Faculty of Forestry in University of Toronto; Dean of Faculty 1907-1919.
History of Forestry published.
1909-10—Forestry Survey of Nova Scotia for the Provincial Government, published in 1912.
1910—The Care of Trees published.
Member of Commission of Conservation of Canada appointed.
1911—Second Edition of History.
1912—Survey of Trent Watershed undertaken for Commission of Conservation.
1917—Amalgamation of Quarterly with Proceedings of Society of American Foresters, editor-in-chief from 1917 to 1923.
1923—Died in Toronto February 6.

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FOREST CONDITIONS IN AUSTRALIA WITH SPECIAL REFERENCE TO VICTORIA[1]

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Considerable has been published in the United States concerning the uncivilized portions of Australia, the wild life and cannibal tribes, strange vegetation, and animals. Most people have heard also of Australia's immense sheep stations, so large indeed that in one place in the Kimberly region in Western Australia, the next door neighbors are eighty miles away, and it takes ten days on horseback to circumvent a single holding! Very few of us, however, have more than a vague idea of her forests or her ordinary civilized life. Yet the two go hand in hand, for it is not the vast wild areas which are forested, but the regions contiguous to the centers of densest population. The well forested area follows the coast line in a belt varying from 50 to 150 miles in width, extending from the northern tropical region on the east around to the central "Nullarbor Plain" near Adelaide in South Australia. Here it dwindles to nothing where the desert joins the Southern Ocean on the shores of Great Australian Bight. The belt starts again in the southwest peninsula and extends up the western shore of the continent to a short distance above Perth where it fades into Mallee scrub, then Mulga, and soon disappears entirely where the arid plains extend westward through to the coast. Still further north, well within the tropics in what is known as the Kimberly region, tree growth reappears, but it is very scattered and scrubby, and from accounts there is nothing which could be counted as prime forest. The Island of Tasmania, now a part of the commonwealth, was originally all forested and at present about 60 per cent of the area is under forest.

An examination of the annual rainfall map shows that the forests correspond quite closely to the regions having 20 inches or more of rain in the temperate, and 30 to 40 inches in the tropics. It is in this

[1] Prepared for the meeting of the Society of American Foresters, Boston, December 29, 1922.

region in the temperate zone that all the large cities are located, Brisbane, Sydney, Melbourne, Adelaide, Perth, and in Tasmania, Launceston and Hobart.

Unlike many countries, in Australia one does not need to travel far from civilization to see the finest of the bush. Most of the forests are accessible by fair roads. Their contiguity to the important centers, which are also seaports, has an important bearing upon their value and future development. The very finest primeval bush in Australia can be visited in a two day's trip from Melbourne at a distance of a

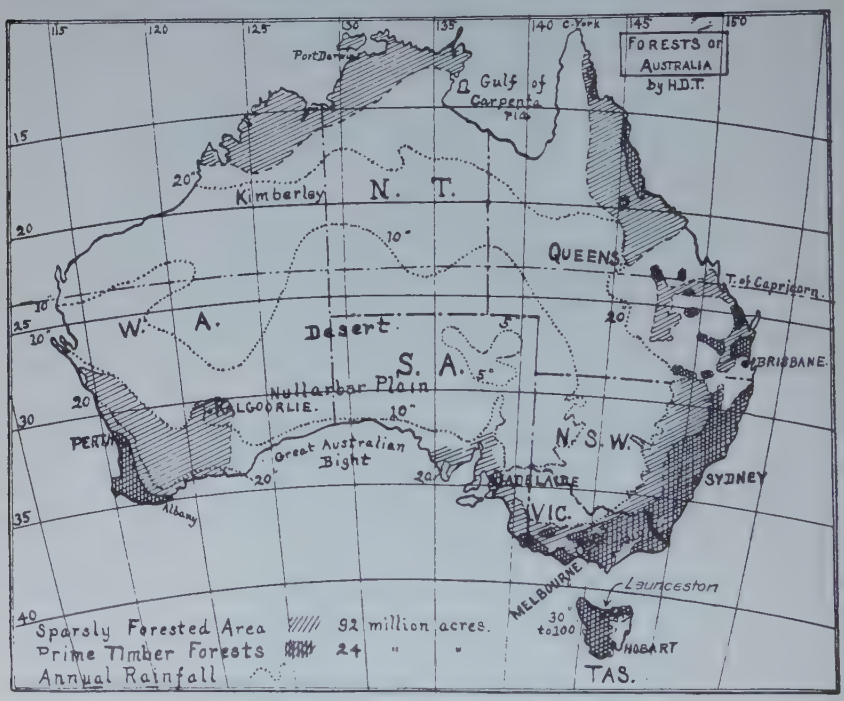

FIG. 1

hundred miles. From Perth, a journey southward of 225 miles, is necessary to see the finest trees of Western Australia, the magnificent Karri.

Inland from this costal belt is a vast agricultural region, savannah-forest, and open prairie land, suitable for cattle and wheat growing; and this again gives place to the great desert or Nullarbor Plain as it is called, in the central extra-tropical portion of the continent. An irregular range of mountains parallels the southeastern coast lying

50 to 100 miles inland and forming the inland border of the forest belt, somewhat like our coast range in California, Oregon, and Washington. This is known as the Dividing Range, or sometimes as the Australian Alps, and contains many peaks four to six thousand feet high and the highest mountain in Australia, Kosciusco in New South Wales is 7200. These mountains are mostly forested, up to 4000 or 4500 feet, with species of eucalyptus and acacia. In the southwestern part of the continent, a low ridge elevated some five or six hundred feet above the costal plains, with occasional peaks up to 1910 feet elevation extends just east of Perth paralleling the coast southward for about 200 miles and fifteen to twenty miles inland. This is, however, more like an escarpment and is known as the Darling Scarp. It forms the dividing edge between an upper granitic plateau, and the lower tertiary costal plain. It is on the upper and inland portion of this ridge that the best forests of Jarrah grow, forming a belt of about 35 or 40 miles in width. Further inland the bush becomes scrubby and open, and is composed largely of low-growing trees such as Salmon Gum, Mallet, York Gum, Wandoo, Gimlet Gum, Raspberry Jam, (*Acacia acuminata*) Sandalwood, (*Santalum cygnorium*) Morrell, and Mallee scrub, and further north Mulga scrub.

Compared to the total land area Australia has the smallest proportion of timber forest of any of the great divisions of the globe, being less than five per cent. It must be borne in mind that this estimate is only a rough approximation as no accurate knowledge of forest areas exists, and furthermore that immense areas are covered with scrubby growths of eucalypts, acacias as mulga, myall, etc., cypress pines, banksias, casuarinas and other species which cannot be classed as timber land. As D. E. Hutchins, Conservator of Forests, British East Africa, has pointed out in his excellent book on Australian Forestry, such an estimate does not give a fair comparison. The relative habitability of the land area must be taken into consideration. As roughly one-third of Australia is desert and half of the remaining portion lies within the tropics, the area suitable for supporting a dense population is comparatively small. He estimates the proportion of forest land to that capable of supporting a dense white population as follows:

The total area including Tasmania is almost the same as that of the United States exclusive of Alaska, namely, 2,974,581 square miles. The area with less than ten inches annual rainfall is given as 1,077,245 square miles, most of which lies outside the tropics. Of the remaining area, with over ten inches rainfall, 957,716 square miles has a rainfall

between ten and twenty inches, nearly half of which is within the tropics, so there is an area of about 500,000 square miles of fairly dry extra-tropical country. Hutchins estimates the potential density of population of this fairly dry area as three-fifths, or an equivalent of 300,000 square miles capable of supporting a dense population. Of the fertile area with rainfall of over twenty inches, over half lies within the tropics, but considering that a portion of this is mountainous, it may be considered as evenly divided between tropical and extra-tropical.

Thus, the area capable of supporting a dense white population may be estimated as follows:

	Acres
Dry, extra-tropical, with 10 to 20 inches rainfall, estimated at three-fifths actual area	192,000,000
Fertile, extra-tropical, with 20 inches and over rainfall	299,708,800
Total potential area	491,708,800

The estimate of well forested land as given in the Yearbook 1921 is 92,000,000 acres which would be 18.7 per cent of this potential area. This, however, certainly includes much scrubby growth such as Mallee, Mulga, etc. The land area actually bearing timber suitable for milling purposes, not including purely agricultural land on which some timber may still be growing, was set down as only 24,000,000 acres at the Interstate Forestry Conference in Perth, 1917. This is only 4.9 per cent of the reduced area as estimated by Hutchins or 1.3 per cent of the total land area. At the Conference of Primiers held in Melbourne in 1920, it was decided that 24,500,000 acres should be made into permanently reserved forest land. This is less than a third of what Hutchins estimates is the minimum requirement (15 per cent) for a normal population.

The present forest is ample for the present population of five and one-half million, but altogether inadequate for future needs. Twenty-five per cent of the land area in permanent forest is a figure well established in European forestry practice as the requirement for a dense population.

In this connection it is of interest to compare the relative areas under forest in the several Australian States as given in the Commonwealth Yearbook, 1921, and to compare them with the figures for other countries.

State	Forested area acres	Per cent of state or of total
New South Wales	11,000,000	5.55
Victoria	11,800,000	20.98
Queensland	40,000,000	9.32
South Australia	3,800,000	1.56
Western Australia	15,900,000	2.55
Tasmania	10,000,000	59.60
Commonwealth	92,500,000	4.86

COMPARED WITH OTHER COUNTRIES

United States	463,000,000	[a]23.90
New Zealand	17,000,000	25.63
Germany[b]	34,569,000	25.90
Austria[b]	24,128,000	31.66
Hungary[b]	22,240,000	29.30
Sweden	57,754,000	52.20
Japan	46,010,000	48.33
Switzerland	2,105,600	20.60
Finland	49,069,000	61.00

[a] This includes 81,000,000 acres denuded and waste area. The figures for actual forested land in the United States are therefore 19.7 per cent and 3.621 acres per capita, exclusive of Alaska.

[b] Areas before the war.

The present population of Australia is five and one-half million. That of the United States is one hundred and five and one-half million. The forested area per capita of population of the two countries is therefore: Australia, 16.82 acres per capita; United States, 4.39 (not including Alaska), and that of several other countries: New Zealand, 13.51; Germany, 0.539; Austria-Hungary, 0.886; Sweden, 9.93; Japan, 0.796; Switzerland, 0.534; Finland, 14.74.

When one takes into account, however, the great devastation that has been going on in Australia in ringbarking and fire, it seems probable that the estimate here given for Australia is altogether too high. Even so, it is evident that for the present population, Australia has an excess of timber, but she will need to conserve all available forest area for a future normal development in population. At the Conference of Premiers, held at Melbourne, May, 1920, it was decided that to meet the future requirements of Australia, a forest area (perma-

nent reservation) of 24,500,000 acres would be necessary, distributed as follows, in acres:

Recommended		Present reservations		Date of statistics
		Permanent	Temporary	
Queensland,	6,000,000	1,348,146	2,679,091	June 30, 1920
New South Wales,	8,000,000	5,254,165	1,518,597	Dec. 31, 1921
Victoria,	5,500,000	3,405,163	757,410	Dec. 31, 1921
Southern Australia,	500,000	459,490 Present and proposed		Sept. 14, 1921
Western Australia,	3,000,000	45,068 in all		Dec. 31, 1921
Tasmania,	1,500,000	13,560	1,672,000	April, 1922
Total,	24,500,000	10,525,592	6,627,098	

The total present permanent and temporary reservations amount to 17,152,690 acres.

Fire is the bane of Australian forestry even to a greater extent than in our country, and at present by far the most important consideration lies in the prevention of fire. In the United States there has been developed through the untiring efforts of those interested in forestry a strong public sentiment. In Australia this is almost wholly lacking. The forestry departments of the several states are alive to the needs as are also many citizens and manufacturers, but among the settlers, ranchers, and people in general, there is almost fatal apathy. Frequently one is met with the statement that the occasional fires do no harm, in fact that they improve the forests and prevent more serious killing fires. It is hard to convince the bushman (a term equivalent to our "lumber jack," with no reference to the cannibals) that repeated fires even though they may not destroy the immediate timber value of the large trees, nevertheless are fatal to the future forest-potential of the area.

Everywhere one meets with fires during the dry season, or the effect of fires. It is deplorable and very disheartening and depressing. It is often difficult to find an area of primeval forest unmarred by the scars of fire. In Western Australia, on a motor ride of some 230 miles and return through the best forest land in the state, I did not

see one acre which had not been injured by fire, and in many places fires were smoldering or burning. Returning, we rode all night long and frequently a spark would drift across the road, coming from no visible place and disappearing in the distance. Occasionally a log or a stump would be smoldering with a weird light, or way on high, 100 feet above the ground, would be a bright red glow like a signal light on a railway. It was a very cold night, and yet for miles at a time we would ride through warm strata of air (a pleasant relief to our stiffened and shivering limbs), yet very depressing when one realized that the welcome warmth came from neighboring fires. I searched a long time in the Karri bush to obtain a photograph of these magnificent trees, which would be free from fire scars. Finally I obtained the one shown, which, however, is partly a camouflage since the shrubbery is all dead from a recent ground fire and the scar on one tree is hidden on the far side! Many of these big trees are badly burned out at the butts, and the young trees are stunted or killed. The crying need of Australia from Tasmania to northern Queensland is *fire prevention* and an awakening of the present apathy. One falls in raptures with the unspoiled Australia bush and soon gets to love it, as we do our own, and it is with feelings of great sadness and a sense of cruelty that he sees it gradually being spoiled by the great world-wide enemy. The forest departments are doing all they can, with the inadequate means available. It must be remembered that Australia is a land of immense distances and very few people (density per square mile, 1.84) and that beyond the cities it has hardly emerged from its pioneer days. Forests are an enemy as well as a friend to the early settler. Unless he can clear the land, he cannot exist. He must clear in the cheapest manner and with least expenditure of labor. Ringbarking and burning is often the only practicable means at his disposal. The cattle men must have grass and burning is the easiest way to obtain immediate results. But why should the settler enter the forest when there are vast areas of open land further inland? Here is where the Government has blundered in opening up to settlers regions of the finest forest which should never have been alienated from the state, but kept as perpetual forest land. The Otway peninsula in southern Victoria was once covered with one of the finest forests in all Australia. The area was opened up to settlement, and the trees were ringbarked, several small fires went through, and finally with the tall dead trees all set for the occasion, a terrific fire swept through and wiped out practically everything including the houses and

barns of the settlers. Only in the deep gullies did the bush escape. It was a frightful example, in which many lives were lost, and an area of about fifty by sixty miles of forest laid waste. It has gone down in history as Black Thursday, for the day was turned to night in all the surrounding country by the dense smoke. Little reproduction has occurred for reasons I will explain presently, and the area is now largely waste land with millions of partly burned poles standing tall and gaunt like gravestones to the departed forest. This occurred in February, 1919. Many of the poles still standing bear witness to the splendid timber which once clothed these hills. Some are still hundreds of feet tall. I measured one blackened stump of a felled eucalyptus tree twelve feet in diameter at twelve feet above the ground, and there were many such. The photograph is of the remains of one of the many departed homesteads, the picket fence is visible and is all that was left.

The fire problem in the eucalyptus forest is a peculiar one and quite different from that in our American forests. The loose stringy bark carries the fire well up into the tops of the trees, and the sparks from the leaves which are thick and full of oil glow for a considerable time and are carried great distances in the air. A single fire or repeated fires, however, seldom kill the larger trees. The eucalypts have a marvelous tenacity of life, and they will sprout when other species would be long dead, so the deformed trees go on growing after the fires, and clutter the ground, hampering reproduction, and with their shredding bark and falling leaves forming fuel for future fires. When an area can be completely cleared after a fire or where the fire is severe enough to destroy the standing trees, splendid reproduction often follows from seed which has long lain dormant in the duff, or soil. Reproduction is no problem at all in eucalyptus forests where fire can be kept out as it is so remarkably vigorous. But where the larger trees are half dead-and-alive, and repeated small fires go through, all reproduction is killed. Very frequently when a splendid second growth has become well established and is six feet high and two or three years old, it is completely destroyed by a second fire. This means practical extermination. Like our Douglas fir, the eucalytus will perpetuate itself splendidly where given half a chance, and most species have the advantage of sprouting vigorously from the stumps. The Mountain Ash, however, rarely sprouts. The one requisite is to keep out the repeated fires. A single fire after lumbering is possibly

beneficial in getting rid of the rubbish and preparing the area for the regrowth, but a second fire is disastrous.

Another perplexing factor which prevents reproduction is the brake fern, and it comes about in this manner: The trees are first ringbarked by the settler, to improve the grazing for his sheep, or because one of the conditions of the acquisition of land by the settler is that he shall accomplish a certain amount of "improvement" each year, and ringbarking is rated as an improvement! The sheep trample the ground and destroy all reproduction. Soon the brake fern gains possession of the exposed soil shaded only by the dead trees. This completely destroys the pasture, for nothing will grow once the brake fern comes in. Fire goes through and adds further destruction to all young growth which may have escaped the sheep, but it does not destroy the bracken which sprouts again thickly from its underground rhizomes. The entire grazed area thus degenerates to nothing other than a very thick carpet of bracken fern about knee high which precludes all possible reproduction. The fern can only be gotten rid of by ploughing. Similar areas which have not been grazed by sheep will frequently be covered with a splendid crop of young trees, and the fern does not get a foothold in shady places, or wherever it has crept in, it can do no harm with the young trees already in supremacy, and they will soon shade out the fern.

This is the present condition of the hilly country on the Otway peninsula. Some small areas are well stocked with reproduction, but the greater part is a hopeless wilderness of bracken and dead stumps, no use for pasture and impossible for tree reproduction.

There are many other regions in a similar condition or rapidly approaching this condition, and it is one of the most perplexing problems confronting the Forests Commission, what to do with such areas. Nevertheless, there still remains considerable forest in prime condition, some of which shows no signs of injury by fire.

To give an adequate description of the forests in general would be a task almost equal to describing those of the whole of the United States. The eastern and western, inland, mountain, costal, and tropical are totally different, save that the eucalyptus and acacia are the dominating genera of all except some of the inland types. It would require a volume to give even a cursory view of the whole. I shall attempt, therefore, to confine myself in this article primarily to the forests of the southeastern portion, in Victoria and adjacent regions. Moreover, from the administrative point of view, Australia is unlike the United

States in that there is no federal forestry organization, and each of the six states handles its problems independently. To discuss the forest policy of Australia would be like describing that of six different countries. The states were originally independent colonies, and not until January 1, 1901, was a federation formed, and the term "Colonies" was changed to that of "States." The present form of the forest administrative government for each of the several states, with the dates when the present form was established, are as shown in table on next page.

VICTORIAN FORESTS

Victoria and Tasmania are the best forested states, and in proportion to its area, Victoria has ample forest for its own use.

There are so many species of Eucalypts and Acacias indigenous to Victoria as well as trees of many other genera, that is difficult to state which are the more important. There are altogether some 285 eucalypts, and 412 acacias indigenous to Australia. Out of over seventy species of eucalyptus in this state there are at least twenty of commercial value other than firewood, and there are two species out of some forty other genera which are of prime importance, the Blackwood and the Beech. In addition, many of the Wattles (acacias) are of special value for their bark for tannin. Among them is the Silver wattle (*A. dealbata*) which has been extensively planted in Africa for this purpose, and also the Black wattle (*A. mollissima*). Of the eucalypts the Mountain Ash (*E. regnans;* formerly *E. amygdalina regnans*) unquestionably heads the list. This is the largest and the most impressive tree in Australia. It generally grows in mixture with several other species, as indeed it is seldom that one finds pure stands of any one kind of tree, except in the drier open interior country, when sometimes Red Gum (*E. rostrata*) will be found along river courses, or Cypress Pine (*Callitris*) in scattered clumps in the dry land in the northwestern part of the state. The Mountain Ash grows to greatest perfection on moist granitic soils on the lower slopes of the mountains up to elevations of about two thousand feet. It is of splendid form, usually with buttressed base and long clear bole generally one hundred and often one hundred and fifty or more feet to the crown. Trees six to eight feet in diameter twelve feet above the base and three hundred feet high are occasionally met with, but as a rule the big trees of the forest are four to six feet in diameter and two hundred to two hundred and sixty feet high. The popular accounts of the astounding heights of Australian trees are probably

Forest Administrations of the States

State	Designation	Number of head executives	Under the minister of—	Date of forest act establishing present organization	Location head office	Former forest administration
Victoria	Forests Commission	3	Public Instruction Labor and Forests	1918	Melbourne	Forests act passed in 1907, creating Department of State Forests with a Conservator of Forests under Minister of Mines and Forests
N. S. Wales	Forestry Commission	3	Secretary of Lands and Minister of Forests	1916	Sydney	First forest laws enacted 1907
Queensland	Forest Service	1 Director of Forests	Secretary for Public Lands	1904	Brisbane	Only state which has not yet passed a specific Forestry Act giving independent forest authority
S. Australia	Forestry Department	1 Conservator of Forests	Commissioner of Crown Lands and Immigration and Minister of Repatriation	1878	Adelaide	Forestry organization under Conservator of Forests was started in 1878, but at first poor progress was made. Lately it has advanced admirably.
W. Australia	Forests Department	1 Acting Conservator of Forests	Mines, Railways, Police, Industries, Woods and Forests	1918	Perth	Was first a branch of Lands Department, then a branch of Mines Department with a Conservator at head
Tasmania	Forestry Department	1 Conservator of Forests	Lands	1921	Hobart	Formerly Chief Forest Officer, Department of Lands and Surveys Conservator of Forests appointed 1919

fabulous. Undoubtedly in the early days there existed some remarkably tall specimens, but even then it is improbable that they were anywhere near the assigned dimensions. At the Melbourne Exposition in 1888, a reward was offered for an authentic account of the largest living tree. The tallest one found was a *E. regnans,* three hundred and twenty-six feet high with a diameter of slightly over eight feet at six feet above the ground. Subsequently one three hundred and forty-seven feet was found at Colac on the Otway Peninsula, where the great fire occurred already described. That larger trees once existed seems evident from relics. There is a fallen tree near Sassafras about forty miles from Melbourne, which has evidently been lying dead for forty to sixty years, and which measures seventeen feet in diameter twelve feet from the stump. I know of no living trees of this size. It is a great pity that such giants should have become extinct, as indeed with equal regret we must observe that the conditions are almost similar in the case of our own magnificent and unexcelled Redwood. Fortunately, however, we have preserved some of them. There is, I believe, one large Karri tree in Western Australia protected by the state, which so far as I know is the only tree that has been thus protected for its size alone.

However, the loss of the ancient giants need not deter us from an appreciation of the splendor of the present forest wherever it has not been spoiled by fire.

Except in the gullies, the bush is quite open and the sunlight readily filters through the high canopy. All the eucalypts are intolerant of dense shade, and the sickle-shaped leaves generally droop with the pointed tips downward. For this reason also they form little or no protection in a shower of rain. The trunks are straight and cylindrical, and with the exception of the so-called "gums" they are more or less covered with a hard rough bark or a stringy bark which hangs down in long shreds in the case of the Mountain Ash and many others. But the glory of the Australian bush lies in the undergrowth of tree-ferns which grow in abundance almost everywhere. There are two kinds in Victoria; one (*Alsophila australis*) growing interspersed throughout the tall trees on the slopes and valleys. These ferns grow to remarkable heights, like an immense parasol with a top fifteen to twenty feet above the ground and occasionally thirty or even fifty feet, and a crown twenty feet in diameter. The ferns of the other species (*Dicksonia antartica*) grow densely in the damp shady gullies, and have rather the larger crowns, some I have measured twenty-five

feet in diameter and of perfect shape. Words can hardly convey the exquisite beauty of these magnificent relics of past geologic ages. They live to immense age, in fact they are probably as old as the giant trees towering over head. To estimate their age approximately is not difficult since the rate of growth can be determined by the leaf scars. An attempt to do this showed an approximate growth of one foot in nine years. A fern forty feet high would then be three hundred and sixty years old! Their survival during the geological changes which have brought about great variations in most of the plants and animals of the world is doubtless due to their wonderful vigor and tenacity for life. One frequently sees tall blackened specimens in the open fields, where the original forest has long since succumbed to ring-barking and fire, until not a vestige of it remains. These survivors often have a feeble little bunch of green on top with blackened trunk burned down to the core, pitifully struggling for existence, but nevertheless still living! In the forest, when cut down with an axe, the tops will continue to grow vigorously and if left alone will ultimately take root and form a vertical trunk again. The bright green color of these ferns contrasts beautifully with the otherwise sombre sage-green of the eucalypts and acacias, which would otherwise become somewhat monotonous.

The wood of the Mountain Ash is medium hard, of light straw color and of excellent quality when properly dried. It must be dried with care, although it is one of the easiest of the genera to dry under proper conditions. It is used for all building purposes and furniture.

Another species, generally growing in mixture with the Mountain Ash, and if anything more abundant, is "Messmate" (*E. obliqua*). This is also a tall tree, but the lumber is not of as good a quality since it is full of gum pockets and shakes, but it is more durable in the soil. It is used extensively. Other important kinds of eucalypts often growing in mixture with these two are White Gum (*viminalis*), Spotted Gum (*goniocalyx*), Silver Top, (*Sieberiana*), Brown Stringy-bark (*capitellata*), and in some places Blue Gum (*globulus*), and several species of Peppermint, chiefly (*amygdalina*). The White and the Spotted gums are conspicuous by their clean white or spotted trunks free from the outer stringy barks. Growing on higher elevations two thousand to forty-five hundred feet, the Mountain Ash is replaced by another quite similar tree, the Woolly-butt (*E. delegatensis*) which furnishes a splendid wood much resembling our Chestnut. Growing at elevations with cold winters it exhibits distinct annual rings or

grain effect. Another common eucalypt at higher elevation is the Black Sallee (*stellulata*), and the beautiful white-barked Snow Gum (*Coriacea alpina*), both of which grow to the upper tree limit (5500 feet) where the winter snows lie several feet deep, and the temperature sometimes falls to nearly 0 degrees F. It was a great surprise to me to discover eucalypts growing in the snow country! The White Ironbark (*E. eugenioides*), the Mahogany Gum (*E. botryoides*), the Yellow Stringy-bark (*E. Muelleriana*), Forest Red Gum (*E. tereticornis*), and the Bloodwood (*E. corymbosa*), a hard dark red durable wood, are important trees of the southeastern costal lowlands; and in the drier plains the Grey Box (*E. hemiphloia*) is a very useful species for poles, posts and sleepers on account of splendid durability in the soil, ranking with if not exceeding the Western Australian Jarrah in this respect. It is very useful for mining timbers. Along the flats and river bottoms towards the inland will be found the Red Gum (*E. rostrata*), another exceedingly hard and very durable timber. These trees have immense spreading crowns as they grow largely in the open, and are very beautiful and picturesque along the river courses. Scattered throughout the alluvial plants are quantities of the various species of "Box" usually about the size and shape of apple trees. The wood of these trees is usually very hard and durable. This by no means exhausts the useful and abundant species of eucalyptus, but is merely an attempt to mention a few of the more conspicuous and important ones.

The common names of the eucalypts as used in different states are very confusing. In New South Wales the terms apply to totally different trees and this must be remembered when consulting literature on trees, such as R. T. Baker's "Hardwoods of Australia." To give a few instances:

Common name	Species	
	In Victoria	In New South Wales
Blue gum	Globulus	Saligna
Mountain ash	Regnans	Delegatensis and sieberiana
Wooly butt	Delegatensis	Longifolia
Spotted gum	Goniocalyx	Maculata
White ironbark	Eugenoides	Paniculata
Peppermint	Amygdalina	Amygdalina and andrewsi
Mahogany gum	Botryoides	.....
Bangalay	.....	Botryoides
Silver top	Sieberiana	Nitens
Manna gum	Viminalis	Rubida

It will be of interest to Californians to follow up the history of the introduction of the eucalyptus into that country and as to why the Tasmanian Blue Gum (*globulus*) was the main species selected. It is by no means the best species for lumber and is not considered so in Australia. It grows chiefly in Tasmania where it reaches immense size, but it also grows in Victoria. From my own observations, the Victorian variety differs from the Tasmanian in having a much closer fitting outer bark which is smoother and runs well up into the tops, and also in the seed capsules which are much smaller. The Californian trees appear to have originated from Tasmanian seed. It will be recalled, by those interested, that T. J. Gillespie established a mill at San Jose in which he cut only a variety claimed by him to be much superior to the ordinary Blue Gum. He used trees of his own selection only which he claimed to have been planted from seed brought over from Australia many years ago by a Bishop Taylor of the Methodist Church. Experiments which I conducted in kiln-drying eucalypts in Berkeley in the winters of 1912 to 1913, and 1913 to 1914, certainly bore out Gillespie's statements to the effect that these "San Jose" Blue Gums, or *"megobolus"* as he unwittingly termed them, contained wood of superior quality. In Australia I was able to confirm the visit of a Bishop Taylor, from California about fifty years ago, who came as an evangelist and succeeded in awakening a remarkable religious movement in Sydney and neighboring regions. I was unable, however, to learn whether he collected any seeds, but it seems very likely that he might have done so, and it would be natural to suppose that he obtained them from neighboring territory, Victoria rather than Tasmania. In other words, the evidence, although not entirely conclusive, is strong that Gillespie's "San Jose" Blue Gums came from Victorian seed, and yielded a better quality timber than the rest of the Californian trees which probably originated from Tasmanian seed.

The Blackwood (*Acacia melanoxylon*) is the finest ornamental wood in Victoria, and is quite on a par with the best woods in the world such as Mahogany and Walnut. It grows best in the gullies of the mountainous regions, but seldom reaches large size. I have seen a Blackwood tree in Beech Forest on the Otway Peninsula which was five feet in diameter and of splendid proportions. This fine species, never very abundant, is becoming rather scarce through cutting. The "Beech" (*Nothofagus*), which is quite nearly related to our own beech, is a lovely tree of large size and dense shiny foliage. The leaves are flat, dark green about the size of the end of a lead pencil and some-

what the shape and consistency of minute holly leaves without prickles and sprinkled with hairs on the upper surface. It grows exclusively in the moist gullies, and is very shade enduring. The wood is pinkish, and of a fine texture resembling California Myrtle. There are two species in Eastern Australia and Tasmania; one is called Tasmanian Myrtle (*Fagus cunninghamii*), the other is a small mountain shrub; and strange to say, four in New Zealand, and none in Western Australia. The New Zealand and Australian species, moreover, are endemic to their own countries.

Some of the less important trees of Victoria from a commercial standpoint are nevertheless very interesting. The "She-Oaks" (*Casuarinas*) such as River Oak, Buloke or "Bull Oak" and Belar are a curious class of trees with leafless-jointed twigs like our horsetail or equisetum. They grow to the size of an apple tree and inhabit the drier regions and hillsides. The wood is reddish with a very striking figure produced by the numerous wide medullary rays, except for the Bela in which the rays are small. There are twenty-nine species growing in Australia, all endemic except one (*C. equisitifolia*).

The family of Proteaceae, of which there are 667 species of thirty-four genera indigenous to Australia, contains what are perhaps the most curious of all the Australian trees and shrubs. There are fifty-eight species in Victoria and 431 in Western Australia. Many of them are shrubs or bushes, but a number reach tree size and are used for timber.

The Banksias, commonly known as Honeysuckles, are exceedingly curious trees of this family with flowers like large bottle brushes or the brushes of a carpet sweeper, and erect pods or cones of irregular grotesque shapes. There are forty-eight species of this genus widely distributed throughout Australia, and there is a closely allied genus in New Zealand (Rewarewa, *Knightia excelsa*). The wood of these is almost as striking in figure as that of the Casuarinas.

The Hakeas of which there are 107 indigenous species, also belong to this queer family and are widely distributed. They are likewise characterized by most curious fruits and foliage. Most of them are shrubby with prickly foliage of the leafless kind and with hard nuts of grotesque shapes resembling horned beetles.

The remarkable native Pear (*Xylomelum occidentale*) of Western Australia with fruit the size and shape of a pear, but of solid hard-wood, is the most curious of all this curious family. You cannot open the tough fibrous pear except with an axe, and yet when ripe it opens

of itself like an oyster liberating two flat thin delicately-winged seeds. What exigency of Nature could have developed such curious fruits as occur among the Proteaceae, it is hard to conceive. Here is a field for the curious. The Waratah (*Telopea*), one of the most striking flowers in existence, is another member of this family. There are three species, the most brilliant florally, being a shrub of New South Wales and Queensland (*Telopea speciosissima*). The flower is brilliant crimson, about the size of a pæony supported vertically on the end of a stiff stem, the outer petals resembling a pæony, while the inner ones are more like an incurved Japanese chrysanthemum. The Victorian species (*T. oreades*) grows to the size of a small tree, with somewhat smaller crimson blossoms. The wood is strongly figured and is used occasionally in cabinet work. The third species (*T. truncata*) is confined to Tasmania. Other genera of this family of Proteaceae, native towards the more tropical regions in New South Wales and Queensland, but not in Victoria, should be mentioned on account of their close relation and their importance and beauty. These are the Silky Oak (*Grevellia robusta*), a fair-sized tree and commonly used as a greenhouse plant in all parts of the world; Beefwood and Wheel of Fire (*Stenocarpus salignus and S. sinuatus*), remarkable trees for their deeply-colored wood and especially the latter for its flowers. They are scarlet-red, shaped like the spokes of a fancy wheel or Japanese parasol, about the size of a small saucer, and as the name implies, reminding one of a pyrotechnic display. The flowers hang downwards with the axis of the "fire-wheel" vertical. Needlewood (*Hakea leucoptera*), so-called on account of the many fine needle-like medullary rays giving the wood a peculiar striated effect, is also used considerably in cabinet work.

There are many other valuable woods in the north, but mention was made only of the Proteaceae on account of their close relation to the Victorian genera and of their remarkable properties.

Still another curious tree quite common in Victoria is the "Native Cherry" (*Exocarpus cupressiformis*). In general appearance it resembles the She-Oaks with horsetail-like foliage or rather branchlets. The thing of special interest about this tree is its fruit from whence its name is derived. It consists of a bright red fleshy drupe slightly larger than a cherry, but with the pit on the *end* instead of the inside! Moreover, this tree, like other members of the Sandalwood family, has parasitic roots. The "Native Plums" or "Damsons" have similar fruits with purple or gray "plums," in which the pit is attached to

the end, entirely outside of the fruit, or more correctly speaking, the fleshy peduncle. These "plums," however, belong to the family of Taxaceae, genus Podocarpus, of which there are six species indigenous to Australia, five of which are endemic. Think of pitless cherries and plums for making pies and preserves! Can you beat it? Unfortunately, however, the plums are insipid, although I have eaten palatable preserves made from them with the addition of some acid fruit juice. The pitless cherries are pleasant to the taste, but astringent, and are not much used.

Of the forest undergrowth besides the Fern Trees there are several shrubs deserving mention. Many of them, it will be seen, like the forest trees, bear familiar names, but are in no way related to their English prototypes.

The "Grass Trees" (*Xanthorrhœa*) are the most curious. They have a thick plume or tuft of grass-like leaves three to four feet in length and grow about as high as a man. The plumes are very graceful and pretty, but look exceedingly odd growing on the top of a very complicated trunk. The trunk has a fibrous pith-like substance in the center four or five inches in diameter and is surrounded by a brush composed of the old base ends of the dead grass leaves like the bracts of a pine cone packed closely together. An extraordinary amount of a red kino or resin is infiltered in this brush called "gum accroides," and is said to have been extensively used by the Germans during the war. The Federal Forest Products Laboratory at Perth is experimenting in the use of the fibrous pith and in the gums and tannins from these queer trees. In Western Australia they grow much higher and are called Blackboys, the trunks being universally blackened by fires. They strongly resemble in size and general appearance our western Yuccas or Dragon Trees. There are thirteen species, three of which are in Victoria. The Blackboys have flower stalks five or six feet high, much resembling our mullen stalks. There is another plant endemic to Western Australia very closely resembling the Blackboys, but belonging to the lily family. It is there known as the Kingia Grass Tree (*Kingia australis*). The only apparent difference is in the blossoms which are arranged in a circular crown of short globula-headed club-like stalks. The properties of the two plants, however, differ considerably. It grows up to twenty-five feet high with a trunk up to ten inches diameter. The structure is the same as the Blackboy except that it is non-resinous and has a netted fibrous cylinder surrounding the pith. This is used extensively in Australia in the manu-

facture of brooms and brushes for rough work. It is said to outwear the piassava for this purpose.

The Tea Tree (*Melaleuca*) abounds everywhere and is universally liked. There are 112 indigenous species, some of them forming dense shady low groves along the seashore. Other species grow to the size of trees and have a thick papery bark which flakes off into tissue-like sheets like sheets of mica. At certain seasons of the year the bushes are completely covered with small white blossoms resembling minute cherry blossoms. Where the name "Tea," sometimes written "Ti," is derived from, I have been unable to determine. One might suppose possibly from the custom of drinking afternoon tea beneath the shade of the groves, but I do not think there is really any connection. It grows in the forests along roadsides and banks of streams, in the open, and along the seashore, often in thick clumps exclusive of other plants.

Another beautiful shrub is the "Christmas Bush" (*Prostanthera lasianthos*) of the family Labiatæ, growing in moist situations both in the forest and in the clearings. It is the size of a very large white lilac bush, and about Christmas time is completely covered with beautiful bunches of lovely little white and pinkish lady-slipper-shaped flowers. It is a lovely sight when in full flower. Other bushes commonly occurring in the Victorian forests, especially on the banks of the gullies and streams, are the Hazel (*Pomaderris apatala*), with simple serrate leaves shiny green above and covered with minute *stellate* hairs underneath; the Blanket-Leaf (one of the Olearia), with large leaves shaped like our Rhododendron, dark green above, but covered with a thick white blanket of woolly hairs underneath; Sassafras (*Atherosperma moschata*), so named from its delightful odor, a rich green shiny-leafed shrub of the gullies. Musk (*Olearia argophylla*), also named from its odor, has bunches of small whitish daisy-like flowers, and leaves shiny green with indented veins above and silvery white underneath, swelled nodules or burls occur at the root, which furnish fancy veneers. The Satin Box (*Eriostemon squameus*), an erect growing shrub furnishes one of the most beautiful woods for small articles such as walking sticks, the wood is of a pale clear straw yellow color. The leaf is glistening green above and silvery beneath, shaped like a willow leaf. Dogwood (*Cassinia*) is abundant and has an attractive white cluster flower like a bridle wreath, but is to be avoided on account of it sometimes producing eruption of the skin. It is certainly remarkable how few poisonous plants there are in

Australia, and except for the snakes there are no really dangerous animals. None of the native trees or shrubs are deciduous.

In this present paper I have attempted to describe the indigenous forests only, and chiefly those of Victoria. The fact should not be overlooked, however, that a great deal of planting of exotic trees has been carried on ever since the gold rush days of 1851 to 1860, both for ornamental and for forestry purposes. Trees from all over the world will be found growing not only in the botanic gardens, but elsewhere. English species have been used mostly for ornamental purposes, but American trees may be found also. For forestry purposes, many thousands of acres have been planted to pines and firs, chiefly P. insignis, laricio, canariensis, and ponderosa, and Oregon (Douglas Fir), roughly about 20,000 acres in all. (In New Zealand nearly double this amount has been planted in hardwoods and softwoods.) Most other species of conifers have been planted also including Larch, Redwood, Menzies' Spruce (Sitka). It is astonishing to see the rate of growth of these trees. Our own Monterey Pine (*Pinus insignis*), especially where planted on the overturned tailings of the gold fields, has made almost unbelievable growth. One might almost be led to believe that this native Californian tree had become enbued with a spirit of patriotism and resolved not to be outdone by any Australian tree, even the eucalyptus! Four feet a year in height growth as an average is not uncommon, and the authentic record is nineteen feet in one year! In South Australia there is a plantation of *insignis* which averaged twenty inches in diameter and 100 feet high at twenty-five years old. I have measured a number of California Redwood trees (*gigantea*), Douglas Firs and Ponderosa Pines over 100 feet high. In some places one might easily imagine he were tramping through our own western coniferous forests. An interesting feature is that in at least one plantation I visited, the Ponderosa Pines were reproducing themselves naturally and vigorously. These plantations are already furnishing a substantial quantity of pine and other softwoods, for boxes, fruit crates, and butter boxes.

But my present article is already too long and a discussion of the planting of exotics must be left for another time.

THE EFFECT OF SOAKING CERTAIN TREE SEEDS IN WATER AT GREENHOUSE TEMPERATURES ON VIABILITY AND THE TIME REQUIRED FOR GERMINATION

By J. W. Toumey and W. D. Durland

(Contributions from School of Forestry, Yale University. No. 22.)

The soaking of certain tree seeds in water for one or more days prior to sowing is a common practice in nursery operations. Nurserymen recognize that with many species it reduces the time required for germination and renders germination more uniform. Thus black locust and many other leguminous species produce seeds which when sown in dry condition often lie in the ground for months without germinating. When soaked for one or more days in hot or tepid water they germinate at once.

The temperature of the water and the length of time that the seeds are submerged are factors of large importance as affecting viability and the time required for germination. Moreover, there is a great difference in species in their power to survive prolonged soaking. Increasing the temperature, within certain limits during the soaking period, shortens the time required for germination. So also, increasing the temperature reduces the time that the seed will withstand submerging without losing their viability. Many tree seeds, such for instance, as locust, oak, hickory and walnut will withstand submerging in cold water for months. Thus acorns are often stored over winter by placing them in strong sacks and submerging them in a moderately rapid stream. No tree seeds, however, so far as known to the writers will withstand overlong soaking in hot, warm or even tepid water without losing their vialibitly. Although the above facts are generally known there appears to be very little specific information on the length of time that different species of tree seed can be submerged at different temperatures without being injured or destroyed. In those cases when germination is materially hastened or rendered more uniform by submerging the seed for a time in water it is important to know how long they should be submerged and at what temperature in order to obtain the best results.

Most species in ordinary nursery practice that are soaked in water for a time before sowing are either placed in water at the normal atmospheric temperature or in hot water, 5° to 10° F. below the boiling point. In the latter case, the hot water with the contained seed gradually assumes the temperature of the surrounding air. In the former case, if the atmospheric temperature is low, but little will be accomplished without prolonged soaking, often for many days. On the other hand, if the atmospheric temperature is high, overlong soaking is likely to kill the seed.

The investigations set forth in this paper were carried out at the Yale School of Forestry, New Haven, Conn., in March, April, and May, 1922. A quantity of clean seed of each of the seventeen species studied was examined for purity and genuineness. All the species were true to name and were relatively free from foreign matter. They appeared sound and fresh by ocular examination, even those collected in the autumn of 1920. A sample of the dry seed of each of the seventeen species was reserved for germination tests and the remainder of the seed of each of the species was placed in glass jars, two-thirds filled with water. One lot of seed in each jar. The jars were placed on a side bench in the greenhouse where they remained for a period of 30 days. At intervals of 3, 5, 10, 20, and 30 days samples from each jar were removed for germination tests. The air temperature in the greenhouse during the period of the tests showed considerable variation between day and night and on different days. The maximum air temperature attained was 92° F. and the minimum 59° F. The mean maximum was 84° F. and the mean minimum 65° F. The mean temperature of the water in the jars was assumed to be 74½° F. which was the mean temperature of the air. The temperature of the soil on the benches in which the seeds were sown showed less fluctuation than the air temperature. It was several degrees higher at night and cooler in the day time, particularly so on days with full sunshine. Continuous records of air and soil temperature were obtained over the duration of the test. The mean relative humidity of the greenhouse air was 61.1 per cent.

The samples of dry seed and those soaked for various lengths of time were sown in rows in prepared beds on the greenhouse benches. Table 1 gives the germination values for the dry seed and for those soaked for different periods. Information is given on the age of the seed, the number in each test, the length of time submerged,

the course of germination in days, the apparently viable but ungerminated seed at the end of the test and on germination values.

Although a single series of germination tests is inadequate to secure entirely trustworthy results, an analysis of the table shows that in the seventeen lots of seed tested, the effects produced by submerging the seed in water at greenhouse temperatures were as follows:

1. Soaking the seed for a limited period prior to sowing reduced the germination energy period in most species. In some species it was not reduced and there was considerable variation in the different species in the degree of reduction. Furthermore, the degree of reduction was affected by the length of soaking. Overlong soaking appeared to extend the energy period.

2. With most species overlong soaking (more than from 5 to 10 days) reduced the number of apparently viable seed that had not germinated in 50 days, which marked the end of the germination tests.

3. The effect of soaking on the percentage of germination obtained varied with the length of time that the seeds remained submerged. With most species overlong soaking greatly reduced the percentage of germination obtained in 50 days, while soaking from 3 to 5 days increased or did not reduce the percentage. On the whole there was considerable reduction in germination when the seeds were soaked for 10 days over that obtained in soaking for 5 days. As a rule soaking for a longer period than 10 days caused a rapid falling off in germination. Only in a few species did any of the seeds remain viable after soaking for 30 days. In certain wet-land species, however, soaking for 15 to 30 days increased the percentage of germination obtained.

4. In the average of the species tested germination energy per cent was slightly increased by soaking for a short period (3 to 5 days). There was, however, much variation in this respect and in general soaking for a longer period than 5 days reduced the germination energy per cent obtained.

The length of time that the tree seeds remained viable when submerged in water at greenhouse temperatures and the germination values obtained in greenhouse tests over a period of 50 days appears to be closely correlated with the site conditions under which the species naturally grow. As a rule the seeds of the upland species that usually germinate under natural conditions in early spring lost their viability with increased rapidity with increase in the time of soaking beyond the period of from 3 to 5 days. On the other hand species which under

natural conditions germinate late in spring or in early summer retained their viability much longer as illustrated in *Pinus strobus* and *Abies balsamea*. Swamp species as illustrated in *Taxodium distichum* and *Liquidambar styraciflua* appeared to have their viability unaffected by soaking for a period as long as 20 to 30 days in moderately warm, stagnant water. In the latter species the highest germinations attained in 50 days were in the samples soaked for 20 and 30 days, in which germinations of 83 and 73 per cent were obtained. The dry sample from the same lot of seed gave a 22 per cent germination in 50 days. Under natural conditions the seeds of these two species are shed for the most part during the winter months. They fall into the stagnant water of their swamp habitats where they sink to the bottom. They are in condition to germinate when the surface water dries away as they remain viable in water which may become stagnant and warm before it disappears in the late spring or early summer. From this study it would appear that seeds from upland species that are carried into swamp habitats are unable to remain viable over the high water period of spring. They are dead when the water dries away and conditions become favorable for germination.

Most leguminous seeds swell to from two to six times the normal size of the dry seed when submerged for a variable length of time in warm or hot water. When sown dry they take up water slowly and not infrequently months intervene before they swell and absorb adequate moisture to induce germination. As soon as swelling takes place the period of dormancy is over and germination begins if conditions are favorable. Thus the seeds of *Gleditsia triacanthos* in the above tests when sown dry exhibited no germination until 30 days after sowing, while samples of the same lot of seed when soaked for 3 and 5 days, respectively, showed their maximum germination in 5 days. Seeds soaked for a longer period than 5 days were non-viable. The explanation of this is a relatively short period of time suffices for the seed to swell when submerged in water at greenhouse temperatures. If the seed is left submerged for a relatively short time after swelling they lose their viability and soon decay.

Table of Germination Values of Dry and Soaked Tree Seeds in Greenhouse Tests.

Species		When Seed Collected	Number Seeds in Test	Number of Days Seed Submerged	Course of Germination in Days								Apparent Viable Seed at End of Test	Germination Values			
					5	10	15	20	25	30	40	50		Germination Period in Days	Germination Energy Per Cent	Germination Per Cent 50 Days	Germination Capacity
Gleditsia triacanthos.	Index Number 1	1921	50	0	0	0	0	0	0	4	6	6	31	40	12	12	12+62
			50	3	1	1	1	1	1	1	1	1	0	5	2	2	2+ 0
			50	5	5	5	5	5	5	5	5	5	0	5	10	10	10+ 0
			50	10	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
			25	20	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
			25	30	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
Taxodium distichum.	2	1921	50	0	0	0	0	0	0	0	0	0	41	.....	.....	.....	0+82
			50	3	0	0	1	1	1	1	1	1	42	15	2	2	2+84
			50	5	0	0	0	1	1	1	1	1	38	20	2	2	2+76
			50	10	0	0	1	1	1	1	1	3	40	50	6	6	6+80
			50	20	0	0	0	1	1	1	1	4	42	50	8	8	8+84
			50	30	0	0	0	0	0	0	0	0	39	.....	.....	.....	0+78
Picea sitchensis	3	1921	100	0	0	0	0	0	19	25	32	37	5	30	25	37	37+ 5
			200	3	0	45	123	129	133	133	133	133	8	15	61.5	66.5	66.5+ 4
			200	5	0	16	117	122	123	123	123	123	4	15	58.5	61.5	61.5+ 2
			200	10	0	38	64	74	80	80	80	80	5	15	32	40	40+2.5
			100	20	0	0	0	8	9	9	9	9	0	20	8	9	9+ 0
			100	30	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
Picea excelsa.	4	1921	100	0	0	0	10	14	16	18	18	18	6	20	14	18	18+ 6
			100	3	3	9	12	12	13	13	13	13	8	15	12	13	13+ 8
			100	5	0	4	7	9	13	14	14	16	11	25	13	16	16+11
			100	10	0	3	5	5	5	5	5	5	6	15	5	5	5+ 6
			100	20	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
			100	30	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
Abies balsamea.	5	1921	100	0	0	0	0	7	10	14	20	27	3	50	27	27	27+ 3
			100	3	0	1	25	32	38	38	38	38	7	25	38	38	38+ 7
			100	5	0	0	18	29	39	39	39	39	4	25	39	39	39+ 4
			100	10	0	2	16	22	28	30	31	31	0	25	28	31	31+ 0
			100	20	0	0	1	3	3	6	9	10	3	40	9	10	10+ 3
			100	30	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
Pinus laricio.	6	1921	50	0	0	11	26	31	50	50	50	50	0	25	100	100	100+ 0
			100	3	14	54	56	57	57	57	57	57	0	10	54	57	57+ 0
			100	5	7	50	51	52	52	52	52	52	0	10	50	52	52+ 0
			100	10	0	38	39	39	40	40	40	40	0	10	38	40	40+ 0
			50	20	0	3	3	3	3	3	3	3	0	10	3	3	3+ 0
			100	30	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0

Table of Germination Values of Dry and Soaked Tree Seeds in Greenhouse Tests—Continued

Species		When Seed Collected	Number Seeds in Test	Number of Days Seed Submerged	Course of Germination in Days								Apparent Viable Seed at End of Test	Germination Values			
					5	10	15	20	25	30	40	50		Germination Period in Days	Germination Energy Per Cent	Germination Per Cent 50 Days	Germination Capacity
Pinus austriaca.	Index Number 7	1921	100	0	0	0	24	28	28	28	28	28	3	15	24	28	28+ 3
			100	3	0	24	31	31	31	31	31	31	1	10	24	31	31+ 1
			50	5	0	11	13	13	13	13	13	13	0	10	22	26	26+ 0
			100	10	0	13	20	20	20	20	20	20	0	15	20	20	20+ 0
			25	20	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
			25	30	0	0	0	0	0	1	1	1	0	30	4	4	4+ 0
Liquidamber styraciflua.	8	1921	100	0	0	0	0	3	5	7	19	22	41	40	19	22	22+41
			100	3	0	1	18	22	25	25	26	27	12	15	18	27	27+12
			100	5	0	6	35	42	44	45	46	46	34	15	35	46	46+34
			100	10	0	48	57	59	59	59	59	59	7	10	48	59	59+ 7
			100	20	0	62	79	83	83	83	83	83	6	15	79	83	**83+ 6**
			100	30	0	2	20	67	71	76	79	79	2	20	67	79	79+ 2
Thuja plicata.	9	1921	100	0	0	0	10	46	56	58	59	60	0	25	56	60	60+ 0
			100	3	0	24	53	53	53	53	53	54	0	15	53	54	54+ 0
			100	5	0	0	44	44	44	44	44	44	0	15	44	44	**44+ 0**
			100	10	0	4	35	37	37	37	37	37	0	15	35	37	37+ 0
			100	20	0	0	14	14	14	14	15	15	0	15	14	15	15+ 0
			100	30	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
Picea pungens.	10	1921	100	0	0	0	10	10	10	10	10	10	0	15	10	10	10+ 0
			100	3	0	21	27	27	27	27	27	27	0	15	27	27	27+ 0
			100	5	0	0	0	0	1	1	1	1	0	25	1	1	1+ 0
			100	10	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
			100	20	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
			100	30	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
Thuja occidentalis.	11	1921	100	0	0	0	10	25	36	40	40	40	0	40	40	40	40+ 0
			100	3	0	0	14	25	39	39	39	39	0	25	39	39	39+ 0
			100	5	0	0	11	30	37	37	37	37	0	25	37	37	37+ 0
			100	10	0	0	6	21	23	23	23	23	0	25	23	23	23+ 0
			100	20	0	0	1	1	2	9	10	11	0	30	9	11	11+ 0
			100	30	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
Pinus silvestris.	12	1920	100	0	0	8	22	45	46	46	47	47	0	20	45	47	47+ 0
			100	3	0	15	26	26	27	27	27	27	0	15	26	27	27+ 0
			100	5	0	8	10	10	10	10	10	10	0	15	10	10	10+ 0
			100	10	0	7	7	8	8	8	8	8	0	10	7	8	8+ 0
			100	20	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
			100	30	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0

Table of Germination Values of Dry and Soaked Tree Seeds in Greenhouse Tests—Continued

Species		When Seed Collected	Number Seeds in Test	Number of Days Seed Submerged	Course of Germination in Days								Apparent Viable Seed at End of Test	Germination Values			
					5	10	15	20	25	30	40	50		Germination Period in Days	Germination Energy Per Cent	Germination Per Cent 50 Days	Germination Capacity
Picea pungens.	Index Number 13	1920	100	0	0	0	51	53	54	54	54	54	0	15	51	54	54+ 0
			100	3	6	44	55	55	56	56	56	56	0	15	55	56	56+ 0
			100	5	0	26	41	41	41	41	41	41	0	15	41	41	41+ 0
			100	10	1	27	40	42	42	42	42	42	0	15	40	42	42+ 0
			100	20	0	15	16	17	18	18	18	18	0	10	15	18	18+ 0
			100	30	0	0	0	1	1	1	1	1	0	20	1	1	1+ 0
Pinus densiflora.	14	1920	100	0	0	0	0	0	8	14	15	18	2	30	14	18	18+ 2
			100	3	0	4	11	13	15	16	16	16	4	25	15	16	16+ 4
			100	5	0	1	14	18	19	19	19	19	1	20	19	19	19+ 1
			100	10	0	9	24	28	28	28	29	29	0	20	28	29	29+ 0
			100	20	0	0	1	2	2	5	5	5	1	30	5	5	5+ 1
			100	30	0	0	0	0	0	0	0	0	0	.....	.....	.....	0+ 0
Pinus resinosa.	15	1920	100	0	0	0	25	50	70	72	72	72	0	25	70	72	72+ 0
			100	3	0	29	58	60	61	61	61	61	0	15	58	61	61+ 0
			100	5	0	9	67	69	69	69	69	69	0	15	67	69	69+ 0
			100	10	0	41	54	56	56	56	56	56	0	15	54	56	56+ 0
			100	20	0	0	5	10	12	12	16	16	0	40	5	16	16+ 0
			100	30	0	0	0	0	0	0	2	2	0	40	2	2	2+ 0
Pinus strobus.	16	1920	100	0	0	0	0	0	0	2	5	8	4	50	8	8	8+ 4
			100	3	0	0	2	5	9	10	10	11	0	25	9	11	11+ 0
			100	5	0	1	4	10	12	12	12	12	0	25	12	12	12+ 0
			100	10	0	0	6	10	15	21	23	23	0	40	23	23	23+ 0
			100	20	0	0	1	5	7	8	8	9	0	30	8	9	9+ 0
			100	30	0	0	0	0	0	0	0	3	0	50	3	3	3+ 0
Picea canadensis.	17	1920	100	0	0	8	24	36	36	36	36	36	4	20	36	36	36+ 4
			100	3	0	20	44	48	49	49	49	49	2	15	44	49	49+ 2
			100	5	0	7	21	25	28	28	28	28	0	20	25	28	28+ 0
			100	10	0	16	31	34	34	34	34	34	0	15	31	34	34+ 0
			100	20	0	3	6	10	12	12	15	15	0	40	15	15	15+ 0
			100	30	0	0	0	0	0	2	4	4	0	40	4	4	4+ 0

DIFFICULTIES IN STATE-WIDE FIRE PROTECTION IN MICHGAN.

By Russell Watson

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The State legislature appropriates $400,000 annually for forestry in Michigan (this figure is about that which it is expected actually will be appropriated this season). Question is: What method of expenditure of this sum will bring the greatest returns, in the form of rebuilt forests, for the State.

Forest fires are spectacular, and their suppression eminently desirable. As foresters we have cried protection from fire, protection from fire, as basic to renewal and extension of the forests. We are right now in the protection-from-fire stage of our forestry development. A few years ago high stumps and poor utilization occupied all attention. Legislators have heeded, and in Michigan three-fourths of the total sum appropriated goes for protection from fire of private lands. We have cried fire protection in an abstract sort of way. If it is highly desirable, therefore let's have it; but when we come to the test, can we have it?

Can we stop fires with $400,000 in Michigan? Can we build improvements so that fires may be stopped more easily in the future? If fires are checked to one acre out of a hundred, will the north country forests rebuild naturally? It is rather essential that we truthfully answer these questions when determining a forestry policy for Michigan.

How much does it cost to stop fires in Michigan? State Forester Schaaf on his State Forests (he has nothing to do with any forestry or fire work outside of these reserves—such is taken care of by the State Fire Warden) has spent in the past 13 years about $50,000 a year on an area averaging about 130,000 acres. On the reserves more intensively equipped and where protection from fire has become an accomplished fact, the cost ranges around 50 cents an acre a year. There is a 10-foot cleared compartment line (fire line) around each 160-acre parcel, and in numerous pieces one around each 40. Each railroad passing through any forest, is bordered by fire lines of the same width. He has a crew of men ready at hand to hit the fires ordinarily a half hour after they are sighted; and he has 14 lookout towners covering 100,000 acres. No part of any forest is more than a quarter of a mile

distant from a road. Telephones connect throughout; and auto trucks and touring cars carry the men to the fires. With all this equipment, which he certainly does not consider too good, he has just about succeeded in stopping fire damage on six States forests.

Most of the money is spent on compartment line construction, roads, planting, brush disposal, thinnings, etc., but it is spent mostly for labor, and this labor is necessary for fire fighting as need arises. Without it, fires would not have been checked. If the custodian of the Hoggins Lake forest had to chase into town 12 miles to get a crew of men every time a fire was reported, he would not now have 15,000 acres without a burn of size in 8 years—practically the only spot of such size in the entire region which has remained green during those years.

The forest supervisor of the Michigan National Forests spends from 10 to 20 cents an acre a year, in much the same manner as does the State forester, and his protection from fire is not at all adequate. In 1919 the Michigan National Forests suffered severely.

The more serious fires to combat, sweep in from outside the forest boundaries. They gather momentum and front before hitting the protection zones. It is appreciated that if the entire State were covered with a protective system that were at all adequate, the cost of protecting any specific area because of reduction of big fires outside would be much less than at present. The number of fires inside would not be less, however, and after all these are quite as serious in some ways as big fires outside. The big fire can be attacked a mile or two outside the boundaries; but the fire inside is doing damage at once.

Altogether in Michigan in the north country we have something like 20,000,000 acres of wild forest land. $400,000 spread over this unkept vast area means 2 cents an acre. If we exclude pay for towermen, we get less than this. In short, at the utmost, each man employed as suppression force must care for the fires on about 25,000 acres.

Of course he cannot do it successfully. A man cannot be in two places at once, and during bad seasons he has several fires on his hands at one time. To get around the difficulty, township officials (as the township supervisor) are employed, and they fight fire and get paid only as need arises. Also, rural postal carriers report fires.

Now in theory and ideally this system of citizens-to-the-rescue sort of a fire department is excellent. The reasoning runs about like this: Fires destroy the country's resources. We depend upon them for a living. Therefore we the citizens of the township will respond heartily

to the call, yea even wait not upon the summons, but like in days of old when danger was imminent, all hands will fly with great speed to the pump, the shovel, and the plow. Leaders will arise to direct the work, men will forget their animosities in the face of the "red, leaping death." However good the theory is, in practice it most certainly hasn't panned out rich. Why fight fire on land owned by an absentee millionaire land owner? Why fight fire at $2 a day when your time is worth $3 or $4,, and easier work? Why fight fire which is doing no harm, since it is only running through brush and grass? Why fight fire anyway? It's a hot, tiresome, mean job with little water and no glory. Life's too short.

When great holocausts arises and threaten communities then, of course, all hands do swarm out and fight fire until they drop; but the little fires, those inconsiderable fellows that do so much damage in the aggregate and are so hard to put out and are so likely to arise into big fires, are passed unnoticed, as a rule, by local people.

Obviously in the face of the sums required by the State forester on the State forests, and the U. S. Forest supervisor on the National Forests, to obtain adequate fire protection, the little 2 cents an acre or less appropriated by the State for State-wide control is hopelessly insufficient. It will give us a protection that is psychological rather than real; it will be of the fancy rather than on the ground. One is reminded of that naive remark an 1898 issue of *The Outlook*, when the National Forest Reserves were first put under administration, and a ranger or two rode herd in the northern Rockies on some thirty or forty million acres: "Already the number of fires and damage done is noticeably on the decrease." Shades of 1910 and 1919 attend!

Now this inadequacy of funds would not be so serious if through its expenditure better protection would be obtained year after year. But such is not the case. No permanent improvements will be obtained. $50,000 will string all the telephone and erect all the fire towers we need. The rest is spent simply on men, and results in no permanent fire-proofing. And this, I think is the principal argument against the present protection-form-fire policy of this State (and it is equally valid in many other States): On lands definitely set aside, as National Forest or State forests, for forestry purposes, money is spent constructively. On these areas we may not obtain good protection immediately, but each year, with more and more improvements, the task becomes easier and easier. They are being rendered fire-proof. State Forester Schaaf has

already actually brought six of our State forests to this idealistic condition. It has cost money, to be sure; but now that they are so equipped, they have the advantage of cheaper and far more certain protection than other areas not so equipped. Insurance is far less; and in this sense, as in sprinkling systems, they pay their own way. Furthermore they are fire-proof for ever, the roads are of the utmost continuous importance in administration, silviculture, utilization, etc. In short, we have built up forestry business for permanency. The test of the fire-proofing lies in the fact that these few State forests have passed through 8 years of serious fire hazard, without losing more than perhaps one-half of one per cent of area burned. Ten years ago, before the improvements were completed, much more money had to be spent to protect than is necessary now; and it was always a gamble whether or not we would get through the season without burning out. Now we are almost certain we will get through safely.

Incidentally, it is a fact that for several seasons these State forests were the only green spots in the region—the surrounding territory was blackened.

On lands other than those State owned (i. e. private lands), however, the State cannot well build any improvements excepting perhaps on some long-term agreement program with the owner, new statutes enacted by the legislature, and much uncertainty all around. Certainly the State is not authorized to spend the money received from taxes spread over all the people of the State to open up roads and trails, build fire lines, bridges, dispose of slash, etc., to improve private property. If such were possible, I know a couple hundred thousand acres of land up north I'd like to have some roads built into right quick. Fire protection is a State-wide business, and properly so, but improvements on private property can hardly be so considered. The State forest fireman is directed and authorized to enter onto private land to extinguish fires that are likely to spread over the country side and endanger the property of neighbors, but of course he cannot build roads or trails on private property. The policeman enters my home to arrest a burglar, but the officer is not paid to put locks and bars on my doors and windows.

The Forest Service in the early days had but a few pennies an acre for the National Forests, but many good improvements resulted. In Michigan, on the contrary, in the past 20 years we have spent for protection on private lands from fires probably close to a million dollars of State and township funds, and have not a permanent improvement ex-

cepting a few cheap towers to show for the money. And the forests saved are conspicuous by their inconspicuosity; we had more than a million acres burned in 1919 and something like 300,000 in 1921.

To repeat, there seems to be no way of escaping this sorry situation. To protect our north country will cost much more money than the State is willing to appropriate year after year, for it must be distinctly understood that appropriations must come regularly without fail or the results of the past seasons protection are likely to go for nothing. To protect for ten years, and then leave go for a year or two with resulting serious fire losses, is as good as useless. I think that it may be laid down as a truth that State-wide fire protection on private lands will come only when the owners are willing to chip in and help out. Very evidently the private land owners of the north, they who hold thousands of acres of cut-over and burned and reburned lands, without good timber or reproduction, who own land merely for speculation, and who are allowing many thousands of acres revert to the State even under present carrying charges, are not going to pay a heavy fire tax willingly. With one or two important but very minor exceptions none have offered to do so; and these exceptions quite properly predicate their offers upon their neighbors doing the same. A blanket, legislature-imposed fire tax of 3 cents an acre over our northern lands, would throw several million acres into tax delinquency immediately. There is no question of this. Personally, I wish it would happen.

Before any private outfit will give money to the State for fire protection, as co-operators do with the Forest Service in the West, the State organization must show itself capable of delivering at least a semblance of good protection. It must have a working nucleus of many State forests, well cared for, to sell the idea, in the first place, and secondly to afford the basis, the foundation, for larger and more extensive operations. One large land-owning company that I am well acquainted with wants to practice forestry on its lands, but realizes the need of fire protection. It is willing and eager to co-operate with the State, but can find nothing substantial in the shape of a good organization to tie up to. If there were a half a dozen State forests well cared for in and adjacent to these holdings then there would be something substantial.

In distinction to the little work done by the State fire warden over the State outside the State forests, the accomplishments on the State forests bulk large. We have on these forests a property that now in-

ventories more than a million dollars; something like a thousand miles of roads and compartment lines, all well kept up, 14,000 acres of plantations, several thousand acres of good natural reproduction, and real forest conditions returning, excellent buildings and accommodations for laborers and families. In short, a going, permanent forest business well established, and a most excellent object lesson in the reconstruction of the north devasted lands, with many farmers living adjacent, working at odd times on the forest and thus supplementing their farm income.

I think it is apparent that the machinery of fire suppression in north Michigan must be that build of forest reserves, under National or State control.

If we stop fires, will trees grow? Of course they will. Trees are the dominating vegetation; one cannot easily keep them out. A tree is a woody perennial with a stem at least 10 feet in length; and that just about describes the trees coming onto our light lands. Aspen, scrub oak, and jack pine dominate. Jack pine with us is at best a boxboard and cordwood scrub; the oaks make about one good tie; and most of the aspen is good for little. In comparison to the high quality of product and high yield per acre of white and norway pines, this scrub stuff is inconsequential. The northern United States and Canada is full of aspen and jack pine, and there is no great call for it from our industries. On the other hand, good white pine and norway are highly valuable and greatly desired.

If fires were by some miraculous fashion entirely stopped in northern Michigan, in about 300 years, perhaps, we would have again a pretty good cover of desirable pines. Supervisor Schreck figures that about 90 per cent of the upland of the Michigan National Forest should be planted. Certainly 75 per cent of our total area of upland needs planting. We do not wish to wait for 300 years to get a forest cover of good species. We have 50 to 100 years of pauperism ahead of us in that region at the best we can do. Every year that it remains idle means a loss of at least $100,000,000 to the State.

Planting is certain, rapid, the best species are used, soil of the highest rent value and of best quality is put to work first, and the work can be done in localities most easily protected. We may rest assured that when the scarcity of timber comes home to our people, that we will not be asked to wait upon natural reproduction.

If we are to spend large sums in protection from fire, should we not at the same time bend all efforts to get the land into productivity as

soon as possible? Why protect grass land and brush when for the same protection investment, and more easily, one can protect growing, thrifty stands? Fire protection in Michigan is like the lightning rod on the barn. It protects the crop, but it grows no good crop of itself. As the farmer who depends upon a volunteer growth gets a thin, scanty crop, so the forester who waits for nature, waits a long time and gets a poor forest.

The fire organization in Michigan plants no trees. The men may not be busied on fire 5 per cent of their time, but they do not spend the other 95 per cent doing anything much of value.

The present fire organization was formed many years ago. It was a gesture of the legislature to appease the earnest request of a number of insistent sincere men who demanded that the State take steps to stop the forest fires. It has not been revamped since then. It may have been considered a good organization at the time, but one cannot tell the value of a forest fire organization until it is tested by fire. It is like building an earthquake-proof skyscraper—it takes an earthquake to test it. No artificial tests can be made. Our organization was soon found to be faulty. Its dependence upon the township supervisor, that already overworked and underpaid individual, has long proven futile of good results.

Summed up, our $400,000 for fire protection spread out over the entire State, practically gets us nowhere. It is not enough to insure protection during any serious fire season, it results in a false sense of security and a feeling that forestry now is an accomplished fact when, of course, it is not, and when it fails to grow forests as it must, all people are disgruntled. It can build no permanent improvements, nor does it do any constructive forestry work, both of which are essential to rehabilitation of the devastated areas. It is exceedingly inefficient, inasmuch as the men must loaf a great part of the time waiting for fires; or if it depends upon emergency labor, results are poor.

I think it highly essential that we get down to brass tacks in our fire work, not only in Michigan but in all States. Instead of spreading thinly over great areas that cannot be built up, we had better concentrate on a few holdings, hold them as forest reserves and put them in order. A State such as Michigan or Minnesota had better put their own many hundreds of thousands of acres of State holdings into shape first before attempting to regulate the whole country side. Many private owners do not care particularly for fire protection and forestry

anyway. Build up, fire-proof the lands that we have; get them into being as worth while forest enterprises before spreading farther. In this way we will soon establish a set of forestry examples that will sell forestry to the people as no amount of scolding, talk of horrors of forest devastation, and national timber famines, can possibly do. Forestry must sell itself through its own good results.

In Michigan we might very easily, through no greater appropriations than we get now, by 1935 have fifty intensively handled State forests, totaling a million acres, under good management, scattered over the northern part of the State. We should buy good lands, rather than use only those dregs that return to State ownership through tax delinquency channels. These forest reserves should form the nucleus of a State-wide fire-fighting organization. It would be an organization to which private outfits could tie to with some certainty of receiving good, earnest, well-studied-out, effective co-operation.

Our dream of State-wide protection, all lands protected under legislative appropriation, is most excellent as a dream; but as in most dreams one wakes up and finds it is chimerical. It is time now to wake up.

THE CONTROL OF WHITE PINE WEEVIL (*PISSODES STROBI*) BY MIXED PLANTING

By Harold Cahill Belyea

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The following study was undertaken for the purpose of comparing liability of white pine to white pine weevil attack in pure and mixed stands. An excellent opportunity was offered for such a study in the plantations of the Great Bear Springs Water Co., near Fulton, N. Y., where both pure and mixed plantations are to be found in blocks of three acres and upwards. These plantations were established in the period 1908-1910 and except for supplemental plantings to fill in the failures no further silvicultural operations have been carried out. A variety of species were used, including white, Norway, Scotch, and western yellow pines, Norway and red spruce, European, Siberian and Japanese larch. Generally these are planted pure in blocks whose size varies from 3 to 15 acres. However, there are a few small blocks in which mixed planting was done.

For the purpose of this investigation three blocks or sub-compartments were selected. The first was a pure plantation of white pine, about 5 acres in area, planted 6 by 6 feet, 90 per cent successful, with Siberian larch refills, which, however, on account of their scattered character play no part in the solution of the problem. The second area selected was a small block of mixed plantation of about the same size. The mixture here was white pine and Scotch pine planted in

Table 1.—*Per Cent Infection of White Pine Weevil (Pissodes strobi) in Three Plantations. Great Bear Springs, Oswego, N. Y.*

Plantation No.	Kind of plantation	Species	Per cent infected	
1	Pure white pine 6 by 6 feet	White pine		73.4
2	White and Scotch pine in alternate rows, 6 by 6 feet	a. White pine b. Scotch pine	35.0 27.9	62.9
3	Pure Scotch pine, 6 by 6 feet	Scotch pine		22.3

alternate rows 6 by 6 feet. The plantation was from 85 to 90 per cent success, and all refills both in the white and the Scotch pine rows were made the following year with white pine. While this did not give absolute conditions of alternate row planting, the conditions were positive enough to provide data for the purpose of this study.

These two plantations are located on areas which have a like site quality value, approximating that of Site Quality I. The land was formerly cleared for agriculture and had been used for field crops in the production of which a certain amount of cultivation had been done. The soil is sandy loam consistency, free from stone or boulders, with the underlying rock located 5 to 15 feet below the surface. The distance between the two plantations is about 300 yards. They are separated by an electric railway right of way and a considerable block of pure Scotch pine which was also studied. The mixed plantation

TABLE 2.—*Number of Trees Per Acre Infected with White Pine Weevil in Pure and Mixed Plantations Species—White and Scotch Pine. Great Bear Springs, Oswego County, N. Y.*

Trees infected	Pure plantation				Mixed plantation. Alternate row Scotch and white pine 6 by 6 feet					
	White pine 6 by 6		Scotch pine 6 by 6		White pine,[a]		Scotch pine,[a]		White and Scotch together	
	No.	Per cent	No.	Per cent	No.[a]	Per cent	No.[a]	Per cent	No.	Per cent
	P. acre		*P. acre*		*P. acre*		*P. acre*		*P. acre*	
With 1 infection per tree	575	64.6	270	100.0	192	90.5	162	95.7	354	93.0
With 2 infections per tree	244	27.5	.....	.....	18	8.5	7	4.3	25	6.5
With 3 infections per tree	63	7.1	.....	.....	2	1.0	.....	.....	2	0.5
With 4 infections per tree	7	0.8	.....	.....	.....	.....	.....	.....	.....	.....
Total No. of trees infected	889	100.0	270	100.0	212	100.0	169	100.0	381	100.0

[a] In the mixed plantation there are only 605 white pine trees per acre as compared with 1,210 for the pure plantations.

is located to windward and in approximately direct line along the direction of the prevailing westerly winds. It is also located on the westerly edge of the plantations and within 200 yards from some native white pine from which the infection may have been received. The prior date of the first infections seems to confirm this.

An intensive examination was made of these three areas for purpose of checking up on the prevalence of white pine weevil infection. The procedure was to examine each tree separately and tally as "Free" or "Infected." Under the heading of "Infected" were a number of subheadings—"Infected once," "Infected two times," "Infected three times," etc. The maximum number of infections per tree was four. Each of these subheadings were in turn subdivided and entitled respectively 1922, 1921, 1920, back to 1909, the year of the establishment of the plantations. The record of each infection was entered into the space corresponding to the year of occurrence as computed by counting back from the 1922 leader. In all some 750 white pine in pure

TABLE 3.—*Schedule of Infections of White Pine Weevil Per Acre in Pure Plantations of White Pine and of Scotch Pine, Planted 6 by 6 Feet. Great Bear Springs, Oswego, N. Y.*

Pure white pine						Pure Scotch pine					
Year	No. of trees infected per acre					Year	No. of trees infected per acre				
	With 1 infection per tree	With 2 infections per tree	With 3 infections per tree	With 4 infections per tree	Total No. of trees infected		With 1 infection per tree	With 2 infections per tree	With 3 infections per tree	With 4 infections per tree	Total No. of trees infected
1910	.....	.....	.....	.....	.....	1910	5	.....	.....	.....	5
1911	.....	.....	.....	.....	.....	1911	64	.....	.....	.....	64
1912	.....	.....	.....	.....	.....	1912	70	.....	.....	.....	70
1913	.....	.....	.....	.....	.....	1913	46	.....	.....	.....	46
1914	4	.....	.....	.....	4	1914	23	.....	.....	.....	23
1915	26	2	1	.....	29	1915	29	.....	.....	.....	29
1916	30	7	4	.....	41	1916	23	.....	.....	.....	29
1917	15	28	6	1	50	1917	5	.....	.....	.....	5
1918	122	50	16	2	190	1918	0	.....	.....	.....	0
1919	156	55	10	1	222	1919	5	.....	.....	.....	5
1920	137	76	15	2	230	1920	.....	.....	.....	.....	.....
1921	74	24	10	1	109	1921	.....	.....	.....	.....	.....
1922	11	2	1	.....	14	1922	.....	.....	.....	.....	.....
Total	575	244	63	7	889	Total	270	.....	.....	.....	270
P. ct.	64.6	27.5	7.1	0.8	100	P. ct.	100	.....	.....	.....	100

plantation and 537 in mixed plantation were examined. It was also judged expedient to examine the alternate rows of Scotch pine in the mixed plantation from which some 450 trees were examined, and also 330 Scotch pine trees in the intervening pure plantation of Scotch pine; a total of about 2,100 trees. These results were then totaled, averaged, and reduced to standard unit acre values. These are summarized in the tables.

For the purpose of comparing on a common basis the degree of infection of the two species under these conditions the figures were re-computed on the basis of number of infections per thousand trees of the species and summarized in Table 5. In order to emphasize this comparison these figures are graphically represented in the accompanying figure 1.

TABLE 4.—*Schedule of Number of Trees Infected Per Acre with White Pine Weevil in Mixed Plantations of White Pine and Scotch Pine Planted in Alternate Rows, 6 by 6 Feet.*

Year	White pine				Scotch pine			Total of white pine and Scotch pine together			
	No. of trees infected per acre				No. of trees infected per acre			No. of trees infected per acre			
	With 1 infection per tree	With 2 infections per tree	With 3 infections per tree	Total No. trees infected per acre	With 1 infection per tree	With 2 infections per tree	Total No. trees infected per acre	With 1 infection per tree	With 2 infections per tree	With 3 infections per tree	Total No. trees infected per acre
1909	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1910	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1911	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1913	3	.....	.....	3	10	.....	10	13	.....	.....	13
1914	2	.....	.....	2	11	.....	11	13	.....	.....	13
1915	9	.....	.....	9	19	2	21	28	2	.....	30
1916	44	2	.....	46	48	5	53	92	7	.....	99
1917	39	3	.....	42	42	.....	42	81	3	.....	84
1918	52	4	.....	56	22	.....	22	74	4	.....	78
1919	27	5	1	33	10	.....	10	37	5	1	43
1920	14	2	1	17	.....	.....	.....	14	2	1	17
1921	2	1	.....	3	.....	.....	.....	2	1	.....	3
1922	.....	1	.....	1	.....	.....	.....	.....	1	.....	1
Total	192	18	2	212	162	7	169	354	25	2	381
P. ct.	90.5	8.5	1.0	100	95.7	4.3	100	93.0	6.4	0.5	100

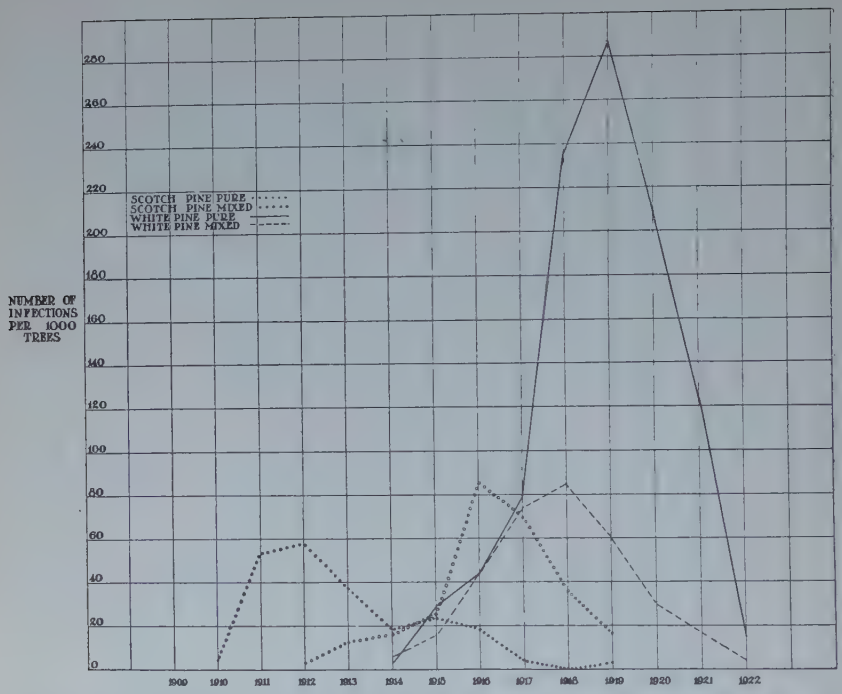

Figure 1. Number of white pine weevil infections per 1,000 trees for white pine and for Scotch pine in pure and mixed plantations. Data taken from examination of some 2,100 trees in the plantations of the Great Bear Springs Water Company, near Fulton, Oswego County, N. Y.

TABLE 5.—*Number Per Thousand Trees Per Year of White Pine Weevil Infections in White and Scotch Pine Planted 6 by 6 Feet in Pure and Mixed (Alternate Rows) Plantations. Great Bear Springs, Oswego, N. Y.*

Year	Pure white pine planted 6 by 6	Pure Scotch pine planted 6 by 6	White pine planted with Scotch pine in alternate rows.	Scotch pine planted with white pine in alternate rows
1910	.....	4	.....	.....
1911	.....	53	.....	.....
1912	.....	58	3	.....
1913	.....	38	5	12
1914	3	19	6	16
1915	29	24	16	26
1916	44	19	44	86
1917	79	4	74	70
1918	236	0	85	36
1919	287	3	60	17
1920	208	.....	30	.....
1921	123	.....	17	.....
1922	15	.....	4	.....
Totals....	1,024	222	344	263

From the foregoing several conclusions may be drawn:

1. The planting of pure plantations of white pine in central and western New York constitutes a severe hazard to the species in regard to the liability of white pine weevil infestation (73.4 per cent infection).

2. The planting of mixed plantations with white pine where Scotch pine is the introduced species does not greatly lessen the liability of infection to the plantation as a whole (only about 10 per cent).

3. Scotch pine while not so susceptible as white pine is liable to white pine weevil infection even where planted in pure stands where the infection may affect between 20 and 25 per cent of the number of trees. The degree of this susceptibility, however, is less than one-third of that of white pine planted pure. This susceptibility will be increased considerably by mixed planting with white pine.

4. The use of Scotch pine with white pine in mixed planting under the conditions described in this article has reduced the amount of infection in white pine by almost 40 per cent.

5. While Scotch pine in mixed plantations is just about as susceptible to weevil infection as the white pine, the fuller use of this method is more than justified on the basis of the lessened infection in the white pine over that in pure plantation of the species. The Scotch pine here acts as a trap tree.

6. It is to be noted that the Scotch pine in pure plantation shows but few secondary infections and no tertiary infections. In the mixed plantation there is a notable reduction in the number of secondary and tertiary infections and an entire absence of quaternel infections in the white pine. This may be taken as evidence of a definite degree of protection offered by the mixed planting.

7. Examination of the tables and figure shows that the peak of the attack on the Scotch pine culminated before it did on the white pine. This is believed to be due to the greater height growth of the species as opposed to that of white pine at the time.

8. The prior infection of the pure Scotch pine plantation is believed to be due to its proximity to a natural growth of white pine, suspected as the source of the infection, rather than to a higher degree of susceptability. It is also to be remembered that at that time the Scotch pine being the faster grower had attained a considerable height growth and was probably a much more conspicuous object of attack than the white pine.

9. The greatest severity of the attack culminated in the years 1916-1920 and has since very rapidly declined. This is believed to be due,

at least so far as the Great Bear Springs plantations are concerned, quite as much to the attaining of a height growth above the zone of greatest risk as to the passing of the insect.

10. It is believed that mixed planting offers a method of control of the white pine weevil. While it does not offer absolute protection to the white pine it does result in relative protection and reduces materially both the severity and duration of the infection.

11. Any experimental plantations of mixed species of hard and white pine undertaken for the purpose of protecting the white pine from weevil infection might prove more efficacious if the plantation containing the white pine were surrounded and isolated by a solid block of pure hard pine plantations. This, however, is offered only as conjecture and suggestion.

12. These conclusions are far from final. There is great need for an extensive and intensive experimentation in planting white pine in different mixtures both as to spacing and species with the idea of determining the effect of such on white pine weevil infection.

THE TECHNICAL NOMENCLATURE OF NORTH AMERICAN TREES

By Geo. B. Sudworth

Dendrologist, U. S. Forest Service

In a recently published paper Mr. Emanuel Fritz presents "A Plea for Common Sense in Changes of Botanical Nomenclature." He asks if it is not time to call a halt in "changing the official botanical or Latin names of trees." This pronouncement is of particular interest now when a revision of the Check List is underway, and a number of changes in the names of important trees are contemplated. Mr. Fritz' protest would seem to indicate that at least a good many foresters have reached the limit of their endurance in accepting further changes in tree nomenclature.

The occasion of Mr. Fritz' complaint was a request for comments from American foresters regarding the advisability of making certain changes in the technical names of some of our trees, these changes seeming to be necessary because of the better undertanding we now have of the specific limitations of some of our trees.

A significant fact is that of those whose opinions were asked or who volunteered them, Mr. Fritz and five other foresters are opposed to any changes, while seven are in favor of the proposed changes. Mr. Fritz, and the California University staff whose opinion he reflects, and five other foresters are opposed to any changes, while seven foresters and their associates are in favor of the proposed changes. Mr. Fritz and others who share his thought feel that the nomenclature of the old Check List should be maintained, regardless of whatever new information may have been gathered since the old Check List was printed. Among these one eminent forester is particularly opposed to further increase of new species, saying, in fact, that there is need rather of reducing the number of different trees enumerated in the old Check List. An example of this need, he says, is Pinus albicaulis and Pinus flexilis, which he considers to be one and the same species!

When the old Check List was published, 25 years ago, the nomenclature used was based on knowledge prevailing at that time. Moreover, it was not believed that the 604 different trees then listed could remain

fixed in number or that the names of all of them could stand for all time. Previously, the total number of trees catalogued by C. S. Sargent in Vol. 9 of the Tenth Census of the United States, was only 412, while the number of trees now listed in the revised Check List is over 1,000. Viewed dispassionately, this means that our present knowledge of North American trees has been greatly increased during the last 25 years, as might well have been expected. Of course, such increase of knowledge is going on in other branches of natural science; in fact, in every branch of human knowledge.

Naturally, time spent in delving in matters purely nomenclatural, is far from interesting to any dendrologist. Of far greater import and interest is the study of the life and relationships of tree plants. Nevertheless, the establishment of stable nomenclature is essential in order to facilitate scientific intercourse.

Systematists have somehow believed that with united effort general agreement on plant names would be accomplished. Attempts to bring about agreement date from the first code of botanical nomenclature adopted in Paris in 1867, down through that adopted by American botanists in Rochester in 1892, the so-called International Code adopted at Vienna in 1905 and at Brussels in 1910, and the American Code adopted in Philadelphia in 1908.

The avowed purpose of these codes was in the interest of stability, and the fact that these codes followed one another so closely showed an earnest desire on the part of systematists to harmonize opposing differences of opinion. As a result of all these efforts to get together, greater harmony now exists among systematists than ever before, and who can reasonably say that those who are laboring to accomplish harmony in scientific nomenclature are not going about it in a rational way?

I realize that there are dissenting voices among foresters who need to have their house permanently in order, and perhaps also among lumbermen and others who have in a very practical way to deal with trees and their products. I realize also that there are dissenting voices among systematists, that they are traveling along more or less diverging paths. Those outside of this body of workers point out that there is confusion even among the plant doctors themselves. Admittedly this is true. Personally, I believe that the very nature of the existing dissentions have already, and in the near future will compel a workable agreement. But this cannot be reached without some compromises on

the part of each faction. For the sake of harmony, an all-important result, mutual concessions must be made, and I believe they will be made.

There are, perhaps, two positions that can be taken with regard to nomenclature, the aim of both being to attain stability. One of these positions involves the somewhat arbitrary action of disregarding the long-maintained principle of priority and of maintaining genera and binomials that have been in familiar use for 20 or more years. Dr. Asa Gray maintained a good many such names, when he knew that they were not the oldest, and naturally his use of them was sufficient authority for others of his time, and even later, to follow. It was not until about 1892 that American systematists began trying to bring about stability by a strict observance of the principle of priority, when even the usage of so revered an authority as Dr. Gray was neglected, in case older names were available.

The other position to be taken regarding nomenclature is primarily based on the observance of priority of publication, the earliest date for tenable genera and binomials being 1753, the date when generic and binomial nomenclature began to be used consistently by Linnaeus and other writers of that period.

But the advocates of this latter position are of necessity bound to follow either the International or the American Code of Nomenclature, both of which are committed to the principle of priority. The International Code cannot be said to have reached the premises, from which it applies priority by a strict observance of this law, but only after having eliminated a long list of "Nomina Rejicienda," and after adopting a long list of "Nomina Conservanda." The American Code is opposed to both of these arbitrarily established lists, preferring to let them stand or fall on their own merits. If one is inclined to be moved by the justice of common law, which is another name for common sense, the position taken by the American Code is a fair one.

The very important question arises, however, will the proponents of these two systems bring about stable usage in plant nomenclature? Both have their advocates in this country. Among American dendrologists, C. S. Sargent is foremost in advocating unswerving allegiance to the International Code. In the preface of his new Manual he announces that the names used in his work are based on the rules adopted by the International Congress, and that these names are used by the largest number of the students of plants; that the confusion in the names of American trees must continue as long as the Department

of Agriculture, including the Forest Service, uses another and now generally unrecognized system. It may also be said that the editors of Gray's new Manual support the International Code. The influence which these two eminent sources of authority exert in this country is a powerful one. In justice, however, to the adherents of the American Code it must also be said that their influence is by no means trivial, for they include a goodly number of able authors of world-wide reputation. Suffice it to say, the adherents of both codes have veritable standings, although it would be difficult to say which has the greater following. By not coming together both factions are in effect keeping up more or less confusion in nomenclature.

If now we admit the desirability of refusing to follow either of these codes, by continuing to use the old Check List names, we can at once be charged with introducing a third element of discord. I cannot see that such a stand on the part of the Forest Service will lead to stability in nomenclature, except among its own members. All other bureaus of the Department of Agriculture that are dealing with plants are following the principles of the American Code. Moreover, all of the bureaus of the Department dealing with both plants and animals are committed to the policy of keeping their nomenclature abreast of the advances constantly being made by systematists outside of the Department. The Forest Service would then have to stand alone. Tree floras of various states are now appearing, the nomenclature of some of which is in accordance either with the International Code or the American Code. None, so far, have had the courage to adopt the nomenclature used 25 years ago.

Clearly we are confronted by a perplexing condition that must be met fairly in accordance with acceptable methods of procedure, and by this I mean procedure likely to have the support and respect of all rational men of science.

Considering for a moment the effect of preserving, unchanged, the nomenclature of the old Check List, there would be practically no recent works on North American trees with which Check List names would be in accord. Sargent's new Manual, now practically the only book dealing with all of our trees, would be almost hopelessly in discord. So also would the nomenclature of Gray's new Manual, which treats practically all of the trees of northeastern United States, have to be translated backward to terms of the old Check List. The same would be true of the several State tree floras that have appeared since 1910.

Even the foresters who want to see the old Check List names preserved, would have to find the connecting link between these old names and those of the newer works describing our forest trees. Add to this inevitable discord, the certainty that still newer works on our trees, sure to come later, are likely to continue to use the nomenclature now thought to be revolutionary. It seems to me easier to absorb and assimilate new changes, as they come, in technical names, than it is to hold to the old ones. Frankly, I do not believe that the Forest Service is strong enough to be a law unto itself in the matter of tree nomenclature.

The whole question of stopping, or of moving on with the advance of knowledge, is greatly complicated and made difficult for the halting proposal, by the necessity of accepting the better understanding we now have of the different forms of trees. We cannot hope to hold back this advance of a new knowledge. By halting with our old names we must inevitably have to attempt to readjust these new facts with the old scheme of names. In a few cases this readjustment will be possible, but in more cases it will be almost impossible. Betula occidentalis Hook of the old Check List is one of the difficult cases, and there are others. Through lack of knowledge in 1898, which we now have, we included two distinct birches under the name Betula occidentalis, the range of which was then believed to be in the Rocky Mountains and Northwest. B. occidentalis actually belongs only to a northwestern birch, while the birch of the Rockies formerly included had to be named B. fontinalis, because limiting B. occidentalis to the Northwest left the Rocky Mountain tree without a name. The same is true of the name Juniperus barbadensis, once understood to apply to the red-wooded cedar of our southeastern coast country, which is now known not to be the same tree as the one named J. barbadensis L. Our tree had to receive a new name, which is J. lucayana Britton. Undeniably such changes are necessary and their validity is bound to be accepted outside of the Forest Service.

Finally, the other alternative is to follow the International Code or the American Code. Still, in choosing this course, we would not escape changes of names nor the consequent temporary confusion. Clearly there is need now of a harmonizing of the differences between these two codes, which contain elements that could be woven into a world-acceptable code. Zoölogists have had many of the same difficulties as plant systematists in their efforts to establish an international code of nomenclature. Without yet accomplishing this, they have, however,

come to the appointment of an International Commission, a sort of higher court, to which mooted questions are referred for settlement, much in the same way that our Supreme Court settles the constitutionality of State or Federal laws. Very encouraging results are being achieved through this International Commission. It seems likely that acceptance of the findings of this judicial body will lead to the establishment of an international code acceptable to all zoölogists. Looking to a similar method of settling mooted questions in plant nomenclature, the Botanical Society of America made a very hopeful beginning at its Baltimore meeting in 1918. The Committee appointed to report on nomenclature recommended the election of a National Nomenclature Commission, the recommendations of which it is believed will pave the way for the establishment of an International Commission. Such a judicial body would be expected to decide all such questions as are at present matters of controversy between the two botanical codes. Another recommendation of the above Committee is the necessity of providing ground for exceptions in the case of well-established plant names. The validating of exceptional plant names by an International Commission would, with other mooted points, mean real progress toward world-agreement. The likely acceptance of the type-basis, a proposal of American botanists, as a means of permanently establishing genera, is another encouraging advance toward agreement. Recent international discussion has brought out proposed concessions and compromises from adherents of both the International and American Codes, so that there are indications now that common ground is being rapidly reached for world-agreement on plant names. Obviously the principle of priority will be preserved, but adherence to it will not be iron-clad. The old first-species interpretation of the rule of priority has failed in securing world-agreement because in notable cases it is arbitrary. Recently indicated desires of botanists to depart from the rigid rules of the International and American Codes find expression in such statements as "rules of nomenclature should commend themselves as being reasonable," and that "they should be as definite as is consistent with reasonableness." An International Botanical Commission doubtless will be called upon to decide cases in which rules are applied with "reasonableness."

In the meantime there is urgent need of publishing a new Check List, representing a "reasonable" interpretation of our tree flora. Shall it be on the basis of what we knew of our trees 25 years ago, or shall it be in accordance with what we know now?

REVIEWS

The National Parks Service: Its History, Activities, and Organization. By Jenks Cameron. Institute for Government Research. D. Appleton and Company, New York. Pp. 1-172.

This compilation on the National Parks Service is uniform with other service monograms published by the Institute for Government Research. They are all prepared according to a uniform plan, including history and development, specific functions, organizations plan, laws and regulations, financial statements, and a complete bibliography. In the foreword it is argued that these Institute monographs will be of value to the Government administrations, members of Congress and to the public. They are wholly descriptive in character and do not examine the various administrations from the standpoint of a critical analysis.

While the so-called Hot Springs National Park was established by act of April 20, 1832, its withdrawal was solely to protect the medicinal springs rather than to establish such a National Park as the Yellowstone, which was the first true National Park established in the United States—1872. The distinction between a national park and a national monument it that the monument protects "some object of historic, scientific, or other interest;" the park is a larger and broader withdrawal in order to develop an area for a more complete and perfect enjoyment by the people.

The most comprehensive of our national park policies was set forth by the late Secretary Lane in a letter to Director Mather on May 13, 1918. "This policy," in the words of Secretary Lane, "is based on three broad principles: First, that the national parks must be maintained in absolutely unimpaired form for the use of future generations as well as those of our own time; second, that they are set apart for the use, observation, health, and pleasure of the people; and third, that the national interest must dictate all decisions affecting public or private enterprise in the parks."

Essentially, it is the policy of the Parks Service to preserve the parks for posterity, and their commercial use is only incidental to the accommodation and enjoyment of visitors. The grazing of cattle is only permitted where no injury will result. The leases only cover the areas necessary for hotels, camps or other facilities. The leasing of camp

sites for individuals is not permitted, nor is the commercial cutting of trees, except along landscape lines. Private holdings are to be gradually bought out and every opportunity is given the public to use the park both from recreational and educational standpoints. Low priced camps are maintained as well as luxurious hotels, and the revenue to the Government (in 1920 about one-third the cost of administration) is of secondary importance.

The administration of the National Park Service is now centered entirely in the Department of Interior. Prior to 1918 the administration was two fold, (1) under the Department of Interior and (2) under the War Department. When it is considered that this organization was further complicated by a separate Army engineer administrative office, the unification under the Interior Department may be signalized as a distinct improvement. Civilian rangers have now taken the place of cavalry in policing the more important parks.

One of the great problems of the future is whether the pressure for water, water power, and other commercial uses will gradually encroach upon the recreational side of national parks. Clearly the present administration has much constructive work to perform and many problems to solve; for example, in the Grand Canyon, Coconino County charges a dollar a head for the use of the Bright Angel Trail based on a capitalization of $100,000 as the value of the trail, when the National Parks Service could probably build a new trail for $30,000 and provide free access to the Grand Canyon of the Colorado. T. S. W., Jr.

The Forests of New York State. By A. B. Recknagel, Professor of Forest Management and Utilization at Cornell University. Pp. 161. Illustrated with photographs, maps, and diagrams.

During the past two decades the problems of national forestry have tended to over-shadow in public interest those of the individual States. The Federal Government has a large role to play in any comprehensive policy of forestry for the nation, both in its direct activities and in its leadership in the states. Each State, however, has also a large responsibility in forestry, and it is gratifying that many of them are going forward by progressive steps in organized fire protection, in acquiring public forests, and in educating the woodland owners and general public to a better appreciation of their forests and the need of forestry.

It is natural to look to New York as a leader in State forestry. About 40 years ago it gave recognition to the forest problem, when it estab-

lished the State forest preserves. It has expended large sums for the extension of its reservations and now has the largest public forest area under actual supervision of any State. An immense amount of study has been given to the forest problems of the State and the literature about the forests in New York is very voluminous.

In "The Forests of New York State" Professor Recknagel has brought together the results of all this study, including material for which he himself is largely responsible. He has done for New York what is needed in every State. He has stated the problem of forestry, presenting the facts regarding the forests, and showing what they mean to the State, to its industries, to its rural development, to the welfare of the citizens generally. He points out the consequences of the failure to handle the forests intelligently. He outlines the needs of forestry and the benefits that might be secured to the owners of woodlands, to the industries and to the public. And he presents his own conclusions regarding various steps needed to bring about the extension of forestry practice throughout the State.

The statements regarding the importance of forest products to the manufacturing industries of the State are very impressive. Next to Maine, New York leads in the production of wood pulp and in the consumption of pulp wood. One-half of the news print made in the United States comes from the paper mills of the State. One-sixth of the wood-using industries are located in New York and there are still over 1,200 saw mills in active operation. The wood-using industries alone employ over 137,000 persons, in addition to many thousands who find employment indirectly through their operation. But the forest industries are declining because of the diminution of the available supplies of home-grown raw material. Within 7 years the number of firms engaged in wood-using enterprises has declined 35 per cent. Professor Recknagel explains that a part of this is probably caused by the process of centralization. The figures indicate, however, an alarming tendency.

With reference to the pulp and paper industry, Professor Recknagel shows that over half of the wood used in pulp mills comes from outside the State. Two-thirds of the mills own no timber lands and are therefore dependent upon outside sources, chiefly Canada. The principal home supply of pulp wood is in the Adirondacks. The material now available will last only about 15 years. This does not include the State timber, now closed to use by a provision in the Constitution. Pro-

fessor Recknagel argues for a change in this law in order to permit the use of the mature timber under scientific methods of forestry. "Unless this is done," he says, "the pulp and paper industry of the State is doomed to dwindle, to the detriment of the welfare of all citizens of the State."

It is probable that the author's treatment of the Adirondack problem will cause as much discussion as any part of the book. The question of whether the products of the forests should be utilized and how, is still one of warm controversy. The fact must be recognized that the public forests of New York are today handled as parks. As such they render a public service of importance but they do not fulfill the economic function performed by our National Forests and by the State forests of Pennsylvania and elsewhere. State forests, with the practice of forestry, are essential to the progress of successful forestry in New York as elsewhere, and sooner or later portions at least of the present State preserves will inevitably be placed in that category. Just how that shall be accomplished and what methods shall be employed in the handling of the cuttings is a matter of even greater divergence of opinion than the ultimate need of a change of policy. Many citizens of the State who have opposed opening the Adirondacks to forestry operations now recognize that economic pressure will in time force that action.

Professor Recknagel's book has the great value of brevity and clearness. It is well balanced, with an appropriate emphasis on the land problem and the relation of forests to the upbuilding of rural industries and agriculture. The critic will call attention to the small place given to the influence of forests on water resources. The problem is referred to but rather incidentally. There has been a tendency of late to minimize the economic value of the protection of forests at the headwaters of our rivers. It is well to reiterate the facts in regard to this question. They are demonstrable and they are striking. In New York water-shed protection is a mighty argument for forestry, and it applies very extensively in different parts of the State.

The book deals essentially with forest economies and discusses problems of policy only in a broad way. Thus the author does not go far into the question of opening the Adirondacks to cutting beyond arguing that such action be taken. He touches upon the question of free distribution of planting stock and other State aid without discussing how far this should really go. He refrains from entering upon the controversial subject of how much may be expected of private owners if the

public does its part in fire protection, tax reform, and other cooperative measures, though he makes clear that he does not believe in the mandatory principle. An adequate discussion of these and many other matters of policy would have carried him beyond the scope of his work.

Professor Recknagel has produced a book that will be widely used. I hope that it may be followed by similar works from other states.

H. S. G.

Schlich's Manual of Forestry: Vol. I, Forest Policy in the British Empire. By Sir Wm. Schlich, K. C. I. E. Bradbury, Agnew & Co., Ld. 1922.

A third edition from the pen of such a distinguished practitioner and teacher is of general interest to foresters throughout the world. It is a vast improvement over former editions and includes the results of the imperial forest conferences held in July, 1920, which account for the "flood of new information" which is found in Part 2.

Part 1 deals with the foundation of forest policy; Part 2 deals with forestry in the British Empire. The most complete statements are about forestry in Great Britain and Ireland, British India, Canada, Newfoundland, Union of South Africa, Commonwealth of Australia, and Dominion of New Zealand. The data about the crown colonies and protectorates are sketchy in character, but of great interest. There is nothing at all about North Borneo, Sarawak, Tasmania, or Mauritius.

In Part 1 the conclusions are concisely summarized at the end of each chapter. The treatment of the subject matter is less continental in character than it was in other editions. In speaking of protection forests (page 39) the author follows closely the French forest code. Protection forests, according to Schlich, are justified for the preservation of the soil, water supply, air currents, public health, against avalanches, and for national defense. The French forest code argues that clearing of timber should be opposed for the maintenance of soil, to prevent erosion and silting, to preserve springs and water courses, to protect against coast erosion or for military defense and for public health. The two statements are not dissimilar.

In speaking of the forest policy of a State the author calls attention to the following requirements:

(1) Power should be provided to declare what areas shall be considered as forests and as such come under the provisions of the forest law.

(2) Power to provide for the establishment of State forests sufficient to safeguard the country in the case of an emergency, or to make good any deficiency in the supplies from corporation and private forests; also to prohibit the disposal of State forests without the approval of Government.

(3) Power to determine the extent of rights in forests possessed by third persons, to regulate the exercise of such rights, or to commute them if their exercise should prevent a rational management of the forests.

(4) To prevent the establishment of new rights in areas declared as forests under the law.

(5) To manage the State forests for a sustained yield, and to authorize the State forest authority to take over the management of corporation and private forests, if necessary for the welfare of the country as a whole.

(6) To provide for the efficient protection of the forests and their produce against fire, theft or other damage by third persons, and for the punishment of offenders against the forest law.

(7) To provide for research in questions which have a bearing upon the best possible management and yield of forests and their protection against injurious agencies.

(8) To provide instruction in forestry and allied subjects, and to organize a competent staff for carrying out the forest policy; also to determine the powers and duties of the forest staff.

(9) Power to control corporation and private forests in so far as the welfare of the community demands, and especially as regards the establishment and management of protection forests.

(10) Power to apply the provisions of the forest law to corporation and private forests, with the object of assisting their formation and development, whether desirable.

It is interesting to compare the author's conclusions with those given in the final report of the Forestry Sub-Committee reporting upon forestry in Great Britain, which argues for a forest policy because "dependence on imported timber is a grave source of weakness in war," and because "our supplies of timber in time of peace are precarious and lie too much outside the Empire," and because "afforestation will increase the productiveness and populate very large areas of the British Isles, which are now little better than waste." It is clear from a comparison of these two statements that a true *forest policy* is even broader than national policy.

A very complete table (page 67) shows the increasing amount of unmanufactured timber that is being imported into the British Isles. The average increase per decade amounts to the stupendous figure of 1,280,000 loads, or a total for 1913 of 11,590,000 loads, worth in round figures 150 million dollars. No wonder the British Isles, which have been the most backward in forestry of any important branch of the British Empire, have decided to produce timber.

Perhaps the most interesting and most complete statement is about British India; in India real forestry has been practiced longer and more extensively than in any other part of the British Empire, and Dr. Schlich's treatment is authoritative and interesting. It is divided into six sections, which include a short description of the country, forests of India, importance of forests to the nation, development of forest conservancy, progress of forest administration, and future development of forest conservancy.

The financial results of this British administration in India are amazingly satisfactory. Commencing with the years 1864-1869 and ending with the period 1919-1920, there has been a steadily increasing revenue, and the percentage of surplus to gross revenue has increased from 36 per cent to 42 per cent, and the net surplus from about 450,000 dollars to over seven million dollars per annum.

Fully half the material contained in this new edition is largely digested from recent official reports, but it is up-to-date and is presented in an interesting and systematic manner. T. S. W., Jr.

The Distribution of Vegetation in the United States, As Related to Climatic Conditions. By Burton E. Livingston and Forrest Shreve. Carnegie Institution of Washington, 1921. Pp. 589, plates 72, figs. 74, tables 152.

To establish a definite relationship between the growth of plants and their environment, and especially to determine what conditions limit the natural occurrence of species and types of vegetation is the ultimate end toward which plant ecologists are working. In no field are these relationships of greater importance than in forestry. At several of our forest experiment stations investigations are under way to determine for local regions the relation between climate and soil and the occurrence of forest trees. Livingston and Shreve have attempted such a correlation on a broad scale covering the entire United States, and

including all types of vegetation. Anyone who has given this subject serious thought and who is familiar with the sources of information must have been impressed by the difficulty, if not the utter hopelessness, of such an undertaking at the present time. The geographic distribution of plants is but roughly known. Plant physiologists have discussed in a general way the relation of light, heat, moisture and chemical elements to plant life; but when we ask for a quantitative measure of the effects of these factors, specific information is almost totally lacking. Our knowledge of climatic conditions, from the standpoint of ecology, is exceedingly inadequate. Having in mind these limitations, the authors state in the preface:

"Our work is primarily descriptive, as most ecological work must be for a long time to come, and the discovery of simple concomitancy is our nearest approach toward the establishment of causal relations. We have been led to the view that ecological science can be most rapidly advanced through this general method of quantitative comparison and by the placing upon record of such cases of concomitancy (between plants and their surroundings) as this method is able to bring forth."

From this and many other statements one gathers that this work is regarded as distinctly preliminary, and that its primary purpose is to assemble and organize existing information with the object of formulating an effective plan and starting point for future investigations.

In a chapter entitled "General Influence of the Environment on Plant Life," 50 pages are devoted to a discussion of the role of temperature, moisture, light, chemical and mechanical conditions. This is a concise presentation of what may be considered the most advanced views on these subjects. No reference is made to Coville's work on the effect of cold in stimulating the growth of plants, or to Garner and Allard's determinations of the effect of duration of light; but these publications had not appeared when Livingston and Shreve's manuscript went to press. The discussion considers both the physiological and ecological aspects, thus bridging a gap which too often exists between these two closely related fields. Great emphasis is placed on the need for experimentation under controlled conditions; but at the same time it is recognized that the problem also involves the interpretation of a vast series of uncontrolled experiments in the natural environment.

The general scheme of the study involves: (1) mapping the distribution of types of vegetation and individual species; (2) assembling of climatological data; and (3) correlation of the data under (1) and (2).

Nine broad types of vegetation are recognized and are designated as follows:

1. Desert.
2. Semi-desert.
3. Grassland.
4. Glassland—Deciduous Forest Transition.
5. Deciduous Forest.
6. Northwest Hygrophytic Evergreen Forest.
7. Western Section of the Northern Mesophytic Evergreen Forest.
8. Eastern Section of the Northern Mesophytic Evergreen Forest.
9. Southeastern Mesophytic Evergreen Forest.

A series of maps of the United States shows the location of each of the above areas with subdivisions, and also the distribution of a number of individual species. Prominent among the latter are range maps of forest trees prepared by the Forest Service.

The climatological data have been taken almost entirely from U. S. Weather Bureau publications. From the basic data on temperature, preciptation, humidity and evaporation, a number of other factors or complexes have been derived. Most prominent among these are the Moisture Ratio obtained by dividing precipitation by evaporation for the frostless season; the Physiological Summation of Temperature according to Lehenbauer; and the Moisture-Temperature Indices representing the product of the Moisture Ratio by the Physiological Summation of Temperature. Altogether some 30 climatic phases are dealt with. The values are presented in tabular form and also graphically by means of isoclimatic lines on the vegetation maps. The section on climatic conditions occupies 238 pages, and contains 22 tables, 19 figures and some 34 climatic maps. Some readers will question the wisdom of devoting so much space to this material. The authors justify it on the grounds that it is necessary to show how various values are derived; to determine by test which classes of data are of value; and finally to give future workers the benefit of the compilations here made.

Correlations between plant distribution and climatic conditions are made in three ways: (1) by placing the isoclimatic lines representing various physical factors on the plant distribution maps; (2) by tables showing the maximum and minimum values of each climatic condition

for each vegetational area or distributional area for each species; and (3) by charts showing the amplitude of conditions in each botanical area as compared with the amplitude for the United States as a whole. Here, as in the chapter on climatic conditions, we find a mass of tables and charts based on admittedly inadequate data, the idea being to present the available material such as it is in the hope that it will be supplemented and corrected by future workers.

As may well be expected, coincidences between plant distribution and climatic lines are not always clear. The evidence everywhere points to complex relationship in which not one but several factors figure in limiting the extension of a species or type of vegetation. Nevertheless there are many instances in which a single climatic complex exercises unmistakable dominance. Foremost of these is the moisture ratio for the frostless season. Temperature is clearly a limiting factor in many cases, but it is not always apparent which one of the many aspects of temperature is most important. Composition and texture of the soil, which have received almost no attention in this study, would undoubtedly prove to be important limiting factors. The studies of individual species will at once impress the reader as lacking in specific data. Foresters will notice this especially with reference to forest trees. In Douglas fir, no distinction is made between the coast and mountain forms which are known to differ considerably in their requirements. The same criticism applies to *Pinus ponderosa* and the variety (or species) *scopulorum*. There is nothing to explain the absence of western yellow pine in the Great Basin, and of lodgepole pine in Arizona and New Mexico. These examples merely illustrate the need for intensive local studies of each species, a need which the authors themselves point out.

In most studies, it is difficult to find methods which apply over a wide range of conditions. The scheme of indicating the distribution of vegetation on a map of the United States and correlating this distribution with isoclimatic lines is promising for large vegetational areas covering regions of fairly uniform topography, but it appears unsuited to mountain regions where the character of climate and vegetation is determined almost entirely by altitude and slope exposure. Such meager weather records as exist for the western mountain regions are likely to prove misleading. The same danger applies in varying degree to a large portion of the weather records used in this publication. In view of this fact, the value of the numerous tables and charts to future workers,

except for purposes of demonstration, may well be questioned. Of the various climatic factors or combinations, the evaporation ratio and the physiological summation of temperature promise to be useful when reliable basic data are available. It is believed, however, that these and other factors will have to be modified to meet individual problems. For instance, in dealing with most forest trees, the growing season does not coincide with the frostless period. In certain regions, the moisture ratio should be based on annual precipitation, rather than that of the growing season. Mean temperature, as usually derived, is an unsatisfactory expression of temperature conditions with reference to plant growth. As a critical factor, the mean maximum temperature is believed to be a far better index than the mean, and the reviewer would not be surprised if it proved to be practically as good as the Physiological Summation when the latter is computed from mean daily temperature and efficiency indices which do not apply to the plant concerned. (The Physiological Summation is at present based upon the rate of growth of maize seedlings at various temperatures. Obviously other plants may respond very differently to changes in temperature.)

In pointing out some of the deficiencies of this work, the reviewer realizes that no one is more fully aware of them than are the authors themselves. Working with inadequate and unreliable data is both difficult and unsatisfactory. Yet it is a necessary preliminary step in all investigations to assemble and organize existing information, even though much of it proves later to be valueless. Out of this crude material, Livingston and Shreve, by virtue of their intimate knowledge of this field and an extraordinary capacity for organizing data, have been able to fashion a rough working model, as it were. To complete the work which they have outlined will require the united efforts of all plant physiologists and ecologists for at least another generation.

G. A. P.

PERIODICAL LITERATURE

SOIL, WATER, AND CLIMATE

Forestry in The Netherlands

The forests which originally covered most of The Netherlands were early destroyed, so that by the 13th century it was necessary to import timber from Danzig. In 1833 the forest area was only 169,026 hectares; it gradually increased to 260,923 hectares in 1911, and since then has again decreased, being 247,785 hectares in 1920, or 7.59 per cent of the total land area. The areas of forest are given for individual provinces and by kinds of forest. Conifer high forest covers 134,222 hectares, broadleaf high forest 20,412 hectares, and coppice and willow-holts the remainder. Large areas have been planted since 1889, principally to *Pinus silvestris,* with occasional hardwoods, and along the coasts to the more resistant *Pinus laricio* vars. *austriaca* and *corsica.*

W. N. S.

Diedrich, Eugen. *Die niederländische Forstwirtschaft.* Forstwiss Centralbl., 44:420-424. 1922.

SILVICULTURE, PROTECTION, AND EXTENSION

Delayed Germination of Tree Seeds

The results are given of experiments attempting to hasten germination of *Fraxinus excelsior pendula* and *Tilia europea parvifolia.* Germination tests of 100 ash seeds picked from the tree and freed from the husks, and of 100 similar seeds dried at 35° C. for six weeks, showed practically no difference. The first seed germinated in 5 months, while germination continued for 6 years, at the end of which 34 undried and 36 dried seeds had sprouted. In similar tests of unopened fruits, 7 per cent, and 6 per cent, respectively, germinated within 7 years. The first undried fruit sprouted in 20 months, the first dried one in 2 years. Free seed of linden began to germinate in 15 months, and the last one germinated near the end of the seventh year. Only 14 per cent germinated altogether, while of 100 whole fruits of linden, all decayed without germinating, and of 100 fruits in which a small groove was cut, only one germinated, after 5 years. These tests indicate the desirability of removing the seed from the fruit in sowing ash, and the futility of sowing whole fruits of linden in any case.

W. N. S.

Puchner, H. *Die verzögerte Keimung von Baumsämereien.* Forstwiss. Centralbl., 44:445-455. 1922.

Diseases of Conifer Seedlings

The "damping-off" of conifer seedlings has by various writers been attributed to a fungus (*Fusoma parasiticum*, Tubeuf), to the effect of excessive heating of the surface of the soil, to stagnant moist atmosphere and excessive soil moisture, or to combinations of these causes. Funk's investigations lead him to believe that another cause may be equally important. He has found that *Fusoma* is ordinarily saprophytic, but that it becomes parasitic on seedlings which for various reasons are in a weakened condition, as is also the case with several other fungi of the genera *Fusoma, Fusarium,* and *Botrytis,* which destroy conifer seedlings. Many diseased seedlings are found to have their roots covered with minute mites, probably species of *Tyroplyphus.* It seems probable that the roots wounded by these mites are made susceptible to attack by the fungi. W. N. S.

Funk, Georg. *Zur Kenntnis der Keimlingserkrankungen bei Koniferen.* Forstwiss. Centralbl., 44:381-398. 1922.

Importance of Origin of Seed

While broadleaf species originally predominated in the forests of Germany, they generally gave way to conifers as the better soils were cleared for agriculture and large clear-cut areas were planted to conifers, which were easier to plant and grew more rapidly than oak, beech, and other hardwoods. As a result of the general impoverishment of the forest soils, foresters gradually awoke to the necessity of following nature more closely, increasing the proportion of beech and favoring natural reproduction where practicable. As beech and oak together utilize the soil better than either one alone, the cultivation of oak was stimulated also. Because of its manifold uses and high value, there is no danger of an over production of oak timber, prices for which have risen faster than the general rise in prices caused by the decreased purchasing power of money. The question of source of seed for establishing oak stands, therefore, is of great importance.

The significance of origin of seed is discussed in relation to modern theories of genetics. Those forms of a given species will do best on a given site which have developed on the same or a similar site, as has been shown in the case of pine, spruce, and larch, by Schott, Cieslar, Engler, and others.

On the basis of phenology, six zones can be distinguished within the range of the European white oak (sessile and pedunculate oaks). These

are: (1) A very early zone with insular climate, where the foliage develops before April 24 and the growing period is over 200 days; (2) an early zone with warm climate, foliage appearing between April 24 and May 2, and 180-190 days growing season; (3) an early zone with moderately warm climate, leaves appearing between May 3 and 5, with 163 to 173 days growing season; (4) a late zone with cool climate, vegetation starting from May 6 to 10, and growth lasting for 158 to 162 days; (5) a late zone with cold climate, foliage starting between May 11 and 18 and growth lasting 154 to 157 days; (6) a very late zone with cold climate, starting after May 19 and lasting 145 days or less. The geographical and altitudinal location of these zones is given in some detail. As might be expected, the average growth rates of the oaks developed in the different zones decrease as climatic conditions become less favorable, and growth and yield data must be worked up separately for the several climatic "races." Within each zone the outward forms of the trees have certain characteristics distinguishing them from those of the other zones, and the associated species of trees and smaller vegetation are also different.

While Kienitz, Arndt, Hauch, and others have made some studies of the effects of source of seed, much more comprehensive investigations should be undertaken, and meanwhile the extreme importance should be recognized of using seed adapted to the site. W. N. S.

Matthäi. *Die waldbauliche Bedeutung der Samenprovenienz bei der Eiche.* Forstwiss. Centralbl., 44:405-419, 463-484. 2 figs. 1922.

Report of Swedish Forest Experiment Station

The report gives a brief survey of organization, personnel and expenditures, followed by discussions of the various lines of work. The organization consists of four divisions, as follows: Forest Management, Natural Science, Forest Entomology, and a division for studying natural reproduction in Norrland. Each division has a chief and one or more assistants of recognized scientific standing. The Director, Gunnar Schotte, is also chief of the division of Forest Management. This organization corresponds more nearly to that of the Office of Forest Investigations in our Forest Service than to one of our several forest experiment stations. It should be noted, however, that all of the division chiefs, including the Director, are personally engaged in

research work. The discussion of progress in research covers the field from the administrative rather than the technical point of view. An outline of the program for the next four-year period, 1922-1926, contemplates investigations under the following heads: (1) Forest Regeneration; (2) Development of Stands; (3) Diseases and Injuries; (4) Races of Trees and Acclimatization of Foreign Trees in Sweden; (5) Forest Soils. Summaries of this program are given in German and English.

A detailed financial statement by divisions, shows the total annual expenditures of the station to be as follows: 1918, 148,555 kr.; 1919, 180,833 kr.; 1920, 221,710 kr.; 1921, 288,007 kr. These figures, even when translated into American dollars, represent respectable sums. They assume greater proportions when one bears in mind that the general scale of prices is lower in Sweden than in this country. When it is considered that Sweden has a population of less than 6 millions and that her total area is but little greater than that of the State of California, one can form some conception of the national importance of forest research in that country. Especially significant is the rapid and sustained rise in appropriations. They have increased at the rate of from 22 to 30 per cent per year and have almost doubled during the three years from 1918 to 1921. G. A. P.

Report of the Swedish Forest Experiment Station for the four-year period 1918-1921. Meddel. fr. Stat. Skogsförsöksanst. 19:1; pp. 1-123. 1922.

MENSURATION, FINANCE, AND MANAGEMENT

Study of Forest Increment

Heck discusses some of the results of his 24 years of measurements on permanent sample plots of beech, spruce, ash, and fir. The measurements, taken carefully each year, show the very great annual variations in rates of growth which are obscured in periodic (5-year) measurements. It is also shown that trees with straight, clear stems grow at a faster rate than others—a fact which is of considerable importance in making thinnings. Data are also presented showing the growth by months during several years. In general, diameters measured in the east-west direction are somewhat greater than in a north-south direction. W. N. S.

Heck. *Beiträge zur forstlichen Zuwachskunde.* Forstwiss. Centralbl., 4:290-326, 6 figs. 1922.

POLITICS, EDUCATION, AND LEGISLATION

Forest Policy of Hungary

The Hungarian government has submitted six forestry laws to the National Assembly. The first creates a special fund to promote forestry, afforestation, and technical literature. The second empowers certain credit institutions to lend money on forest properties. The third creates a forestry bureau. The fourth is concerned with organizing the forest administration, under the Department of Agriculture. The fifth is to promote increased production and afforestation, and the sixth deals with encouraging associations for forest workers.

W. N. S.

Sch. *Ungarns Forstpolitik.* Deutsch. Forstztg., 37:991. 1922.

MISCELLANEOUS

Fuel Shortage and Forestry

The fuel shortage has led to heavy cutting of fire wood and use for fuel of timber badly needed for construction and other industrial use. Even if all the timber cut in Germany were used for fuel, it would supply only a small fraction of the need for fuel. To save the forests from destruction and the wood-using industries from ruin, it is necessary to find means of supplying the cities and industrial plants with coal.

W. N. S.

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NOTES

Douglas Fir Plantation in Germany

The following extract from a letter of March 17, from Dr. C. A. Schenck, may be of interest to American foresters:

"Visiting Tharandt with some Oxford foresters, Professor Münch, a new man, heretofore forester in Kaiserslautern, spoke to me of his experimental plantations made with Douglas fir from seeds which, no doubt, you yourself had been instrumental in supplying.

"The purpose of the experiments is this: Münch wants to find what race of Douglas fir will answer best the climatic and the productive requirements, in the upper Rhine valley.

"Schwappach had made similar plantations for Prussia from seeds furnished simultaneously; his plantations have, however, failed to develop.

"The results obtained from measurements taken in the fall of 1921 are shown in Table 1. It struck me that the readers of the Journal might be interested in them although the data fail to be of any practical value for them. Yet it is clear that similar tests must be made wherever Douglas fir is being introduced in the plantations of the good United States of America.

"Douglas fir is the great hope of Germany, in a sense; the hardwoods excepting oak are losing ground more and more; Picea excelsa has many disadvantages by its unfavorable reaction on the productiveness of soil. And—we are threatened by a timber famine, believe it if you can! Our woods have weathered the war wonderfully, but they seem to be unable to face the demand which has arisen now after the war at a time at which we are unable to secure by importations the one-third of the requirements which, prior to war, the north woods and the south woods were furnishing. In addition, owing to a frightful lack of coal, every household is compelled to use fuelwood on a scale never before known.

"No wonder, then, that we are short also in supplying the demands which the Reparation Commission has made on us. These demands are for what amounts to firsts and seconds only—the best of the good. The invasion of the Ruhr is due to our inability to furnish what timber France and Belgium thought they were entitled to obtain. It is not a

question of ill will on the German side; it is rather, in my honest opinion, a lack of power on the side of a government which does not have control of any national forest whatsoever, which is compelled to buy what it needs in the open market, and which does not have any credit—owing to the very action of the Allies, in its own country. Indeed, the Allies have done everything they could to discredit this our first real democratic government. America has taken a hand in the war 'to make the world safe for democracy.' The result is a peace which places a really democratic German government continuously in the worst possible condition. The invasion of the Ruhr is a God-send for our Bolshevists and for our nationalists. And a curse for our young democracy.

TABLE 1.—*Experimental Plantations with Douglas Fir Seedlings Obtained from Various U. S. National Forests Made in the Palatine Province of Bavaria Near Kaiserslautern, Stiftswald.*

No. of strip	Name of National Forest producing the seeds	State	Elevation	Color of needles in 1921	Mean heights of plants		General form
					1917	1921	
			Feet		*Cm.*	*Cm.*	
1	Pike.....	Col.	7,500	Light blue.....	.....	140	Columnar
2	Sophis.....	Col.	7,000	Grayish green and bluish....	57	139	
3	San Isabel..	Col.	8,000	Very blue.....	83	128	
4	Pecos.....	N. M.	?	Quite light blue.	136	263	Columnar
5	Madison...	Mont.	7,600	Grayish green..	41	122	
6	Bitterroot..	Mont.	?	Grayish green..	84	192	
7	Lolo.....	Mont.	3,000	Grayish green..	77	180	
8	Salmon....	Idaho	7,000	Grayish green..	39	91	
13	Colville....	Wash.	3,500	Grayish green..	65	135	
15	Snoqualmie.	Wash.	550	Quite green....	153	296	Broadly branching

In spring 1912, seedlings then 2 years old were planted on a N. W. slope, on a loamy sand soil. The mean heights of the saplings, in the years 1917 and 1921, when they were 8 to 12 years old, are tabulated below. The total area used for the parallel plantations comprising them, the strips running downhill, is in excess of 5 acres.

Alongside with the various races of Douglas fir were planted, at the same time, on 2 acres (in strips 9, 10, 11, 12 and 14) some three-year transplants of other species. These have obtained in the meantime, measured like the Douglas firs in 1921, the following heights: Picea sitkaensis, 317 em.; Abies pectinata, 82; Picea excelsa, 283; Pinus strobus, 374, and Fagus silvatica, 131 cm.

Obviously, for the upper Rhine valley and for the Palatinate in particular, the Douglas race coming from the Snoqualmie National Forest and the race hailing from the Pecos National Forest are best, unless future events should teach another lesson, in years of excessive droughts, frosts, or snowbreaks.

"It may interest you to learn that the Oxford forests, 20 men strong, will come under my tutelage during their Eastern vacation. We shall spend four days a week in the woods, and two days in the class room digesting what we have seen in the woods. We shall see the pineries near Darmstadt and in the hills, the oak woods of the plains and of the Spessart, the change from decrepit coppice to high forest in Heidelberg; then we shall go to the Black Forest and finally to Saxony. The trip will last five weeks in all.

"To me, these visits are of great importance. They give me a chance to assist in reconciling the two countries, England and Germany; and they keep me in touch with the profession, here and in England—India. Further, these visits yield for me a small and badly needed income, for who in Germany will want my services at a time when hundreds of foresters are expelled from Alsace-Lorraine and now from the occupied zone? I have no local experience, and I am 55 years of age, too old for lasting a long time in charge of the woods, too old for re-entering a state forest service.

Z.

Rotary Pump Attachment for 5-Ton "Caterpillar" Tractor

The Holt Manufacturing Company, Peoria, Ill., is now offering an accessory in the form of a rotary pump, which can be readily attached to the standard 5-ton "Caterpillar" tractor. The pump is of special design, compact in size, and is attached to the rear of the tractor in exactly the same position as the power pulley attachment. It is driven direct through the countershaft from the motor and is capable of delivering 220 gallons of water per minute under working pressure of 100 pounds per square inch. At normal speed of 1,000 R.P.M. it throws a 1⅛-inch stream 100 feet in the air and requires but 26 horse-power, which is only approximately two-thirds of the normal motor capacity of the 5-ton "Caterpillar." There is accordingly a large reserve for overloading, should the pump be called upon for extra heavy duty.

This reserve capacity enables the use of a long hose both for intake and discharge. Where an ordinary length of hose is employed a very broad area can be quickly drenched with a very heavy stream. It may prove useful in patrol work in State forests, in the timber districts, etc. The "Caterpillar" has the capacity to travel over all sorts of ground, is able to penetrate to points inaccessible for other machines or vehicles, and is able to travel at an active speed. Where a stream or other water

supply is available the "Caterpillar" with pump attachment can render service in forestry work.

A New Evinrude Pump

The pump is a small Viking special internal gear pump. This is direct connected to the Evinrude 4-5 h.p. two-cylinder two-cycle motor (standard the world over), equipped with the Evinrude Magneto-built-in-the-flywheel. Pump and motor are mounted on a strong aluminum base. The length overall is 31 inches; width, 11½ inches; height, 17 inches; suction, 2 inches; discharge, 1½ inches. The outfit weighs so little and is so designed that two men can carry it easily (the weight is 25 pounds less than any similar equipment). Bolt holes in the base provide for permanent installation, if desired. Either at a head of 277 feet or through one and a third miles of 1½-inch pipe, it will deliver 1,500 gallons per hour. At a pressure of 120 pounds it will throw a stream 100 feet through a ⅜-inch nozzle.

It is claimed that this pump may prove especially useful in fire fighting. The price is $295 f.o.b. Milwaukee, and is manufactured by the Evinrude Motor Co.

SOCIETY AFFAIRS

William Darrow Clark

In the death of William Darrow Clark the Society of American Foresters has lost one of its distinguished Senior Members and the cause of forestry one of its ardent advocates and hard workers. At the time of his death from pneumonia, which occurred at his home in Chapel Hill, N. C., on March 17, 1923, he was Chief Forest Fire Warden in the North Carolina Geological and Economic Survey.

Clark was born in Rahway, N. J., in May, 1877. After preparing at Phillips Andover, he was graduated from the Academic Department of Yale in 1904. He was twice associated with the United States Forest Service and was graduated from the Yale Forest School in June, 1909.

In September, 1909, Clark became Assistant Professor of Forestry in the Pennsylvania State College, at State College, Pa. After three years there he assumed the professorship of forestry in the Massachusetts Agricultural College at Amherst, Mass., where he remained until 1920. In September of that year he accepted the position which brought him to North Carolina.

Clark was a devoted public servant, an indomitable worker, conscientious, and high-minded. He rejoiced especially in field work, and under his energetic direction the organization of forest fire prevention in North Carolina was being developed toward a point of high efficiency.

The loss of a man of such sterling integrity, such high ideals, and with such a likable personality will be keenly felt by all who knew him.

Joseph J. Dearborn

Joseph J. Dearborn, of Athol, Mass., a Senior Member of the Society since 1919, died of pneumonia on May 4. Dearborn was a graduate of the New Hampshire Agricultural College and Harvard Forest School, 1907. For two years he was an assistant forester in the Massachusetts Forestry Department, and since 1909 had been connected with the Diamond Match Co. For the past ten years he has been manager of the Athol (Mass.) plant of this corporation. He was active in civic affairs in his town and at the time of his death he was chairman of the Board of Selectmen.

At a meeting attended by about twenty-five foresters, held at Ann Arbor, Mich., on January 20, the Ohio Valley Section of the Society was organized and by-laws adopted. This action and the by-laws have been approved by the Executive Council as provided by the Constitution. The new Section is to include men residing in Ohio, Indiana, Illinois, Kentucky, and southern Michigan, except that members in eastern Kentucky may prefer to come under the Appalachian Section. The temporary officers of the Section are: Chairman, Edmund Secrest; Secretary, Russell Watson.

At a meeting of the Denver Section on February 10, it was voted to change the name of the Section to Central Rocky Mountain Section. This is in line with the action of several of the other Sections whose names have been changed so as to designate the region covered rather than some one city within the region. This change has been approved by the Executive Council.

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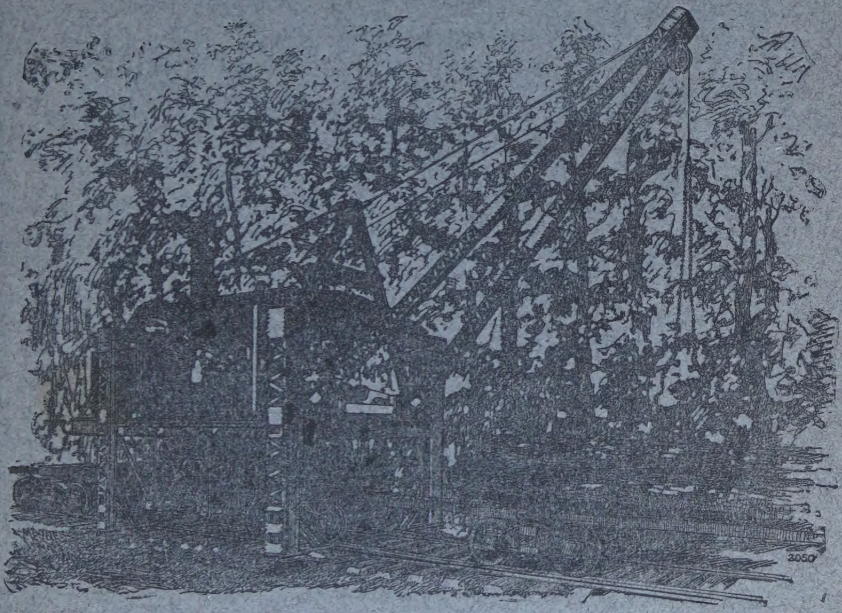

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